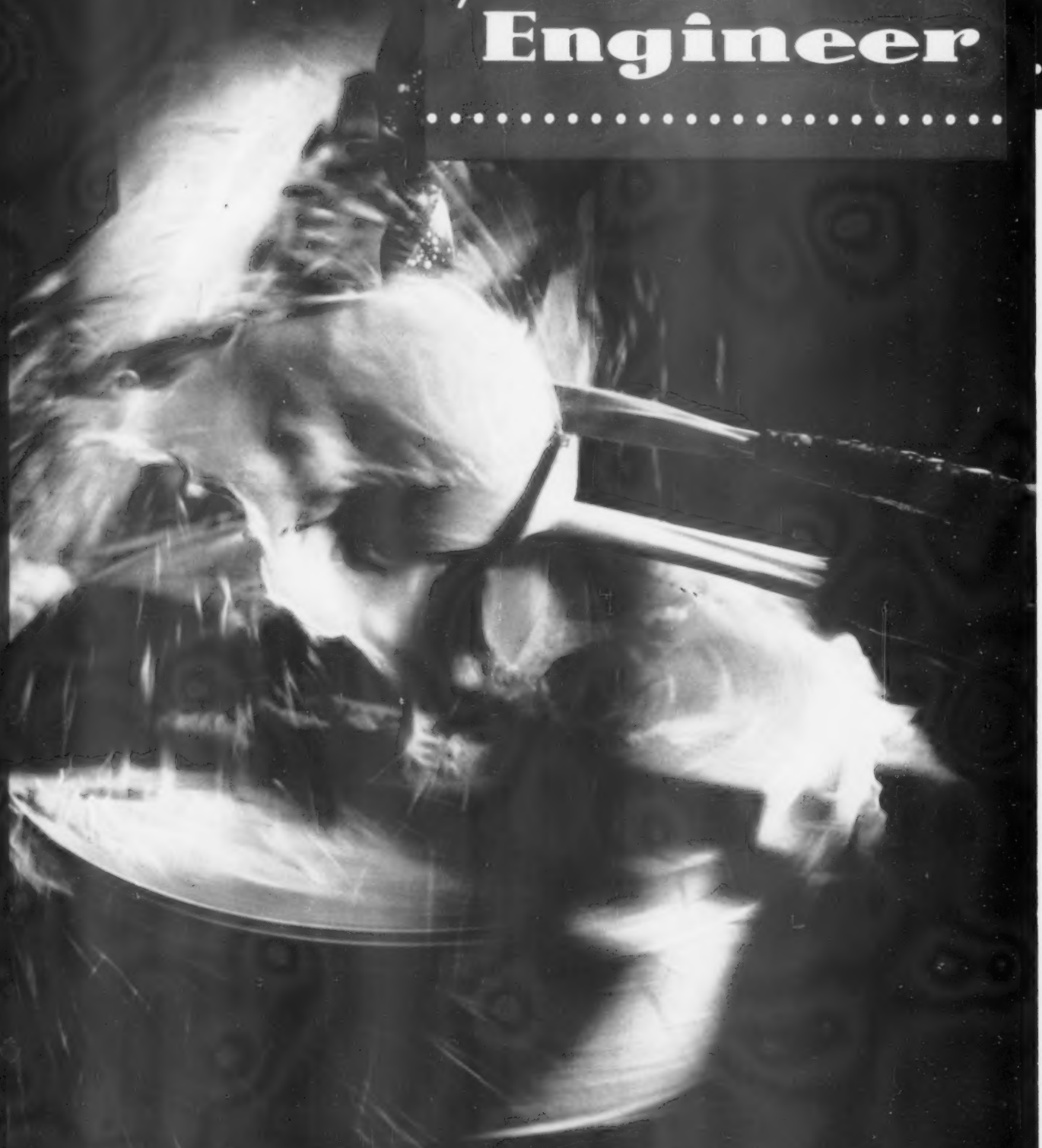
The Tool Engineer



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BLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

JANUARY, 1952

VOLUME XXVIII, NO. 1

PLANNING ENGINEERING CONTROL OF TOOLING EQUIPMENT PRODUCTION

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are conical in shape on *both* ends. The *two tapers*, an exclusive P&W feature, give double assurance of exact alignment and concentricity in the holder. Use them in P&W Duocone Holders — with the concentric-adjustment feature — for the speedy and faultless production of straight and well-formed threads.

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VOLUME XXVIII
NUMBER 1
JANUARY, 1952

The Tool Engineer

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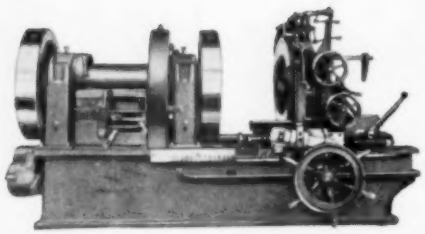

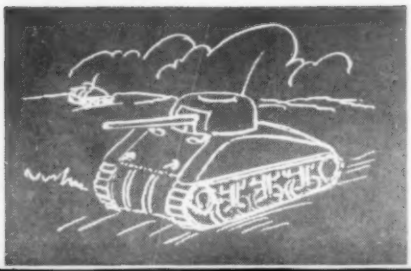

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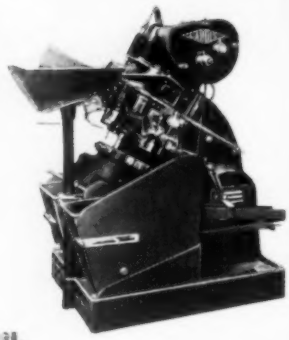

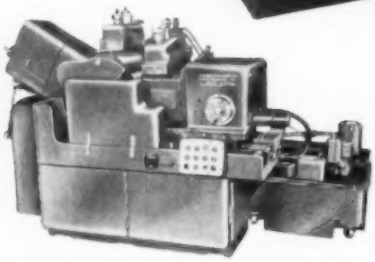

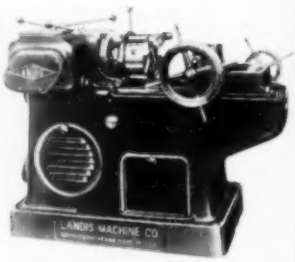

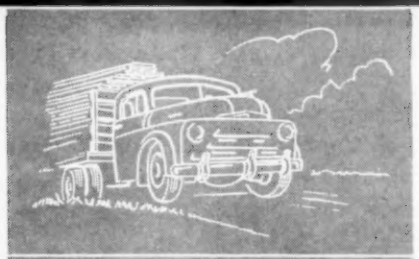

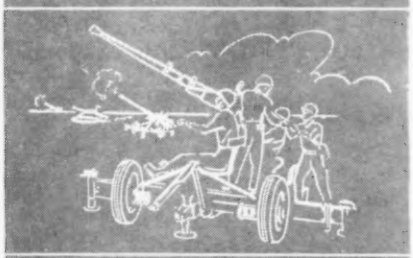

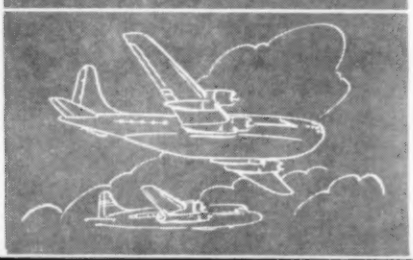

Threads to open bomb doors, or secure warheads on naval rockets—threads to help steer pleasure cars, or to adjust microscopes in research. All of these are produced by one or another of the many types of Landis Threading Equipment, equally adapted to making America strong in war, or building a land of plenty in peace.

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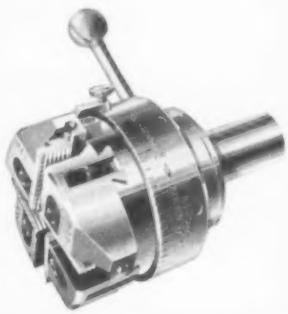

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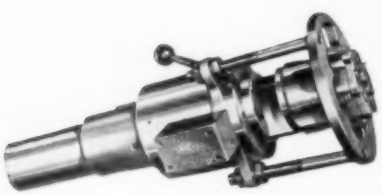

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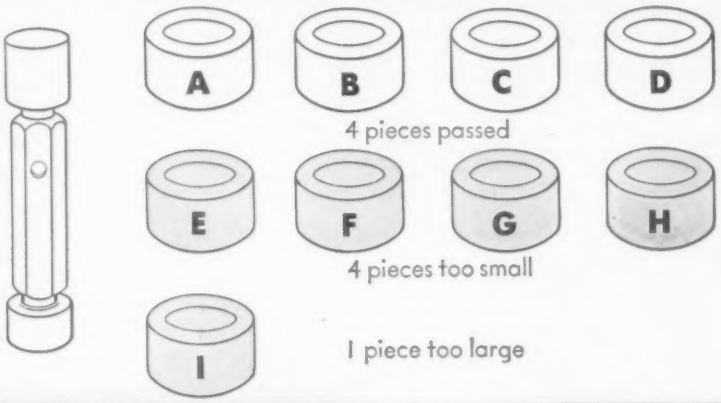
Inspection of 9 pieces using conventional plug gage
Bore Diam. 1.500"; Total Tolerance .001"



RESULTS of same inspection using DuBo Plug Gage

Of the 4 pieces passed by conventional plug gage above, only 3 are actually within specified limits when inspected with the more sensitive DuBo plug gage.

DuBo reveals piece D (passed above) is too large.

Of the 4 rejected as too small by conventional plug gage, E and F are actually within the limit when inspected with DuBo plug gage.

I, rejected by conventional gage as too large, is so verified when inspected with DuBo plug gage.

Of nine pieces inspected, DuBo reclaimed two false rejects and rejected one piece that had been passed by ordinary plug gage inspection. Apply even a fraction of this ratio to a day's production in your own plant and you'll realize the advantage of using DuBo plug gages.

*U.S. and Foreign Patents Granted

At left:
SINGLE END
DuBo Plug. Sizes
1.510" to 6.010"

At right:
DOUBLE END
DuBo Plug. Sizes
.240" to 1.510"

DuBo Plugs Wear 5 to 10 Times Longer than Conventional Plugs

The spherical gaging surface of the DuBo plug gage, specially relieved, has the advantage of easy entry, with contact only at the point of gaging. Lightness in weight, sensitivity and finger-tip control also mean speed and less wear.

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You'll actually save money by using this modern plug gage instead of the out-moded cylindrical plug. DuBo keeps down that high cost of parts needlessly rejected or incorrectly passed. It's all in the design. DuBo plugs simply check better because of the spherical principle on which they are based.

DuBo Saves Inspection Man-Hours

DuBo is only about one-fifth the weight of corresponding conventional plug gages. This factor, coupled with "go" and "not go" color identification, definite check, ease of entry and absence of jamming, reduces inspection time, saves money and increases profitable production! **Write or phone any questions you have on this vastly better checking device.**

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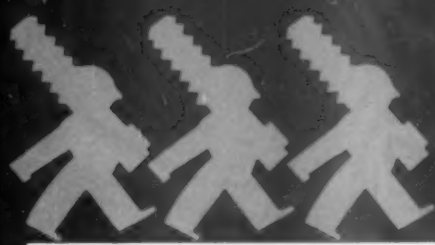

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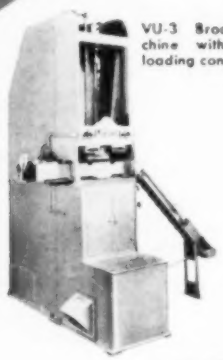
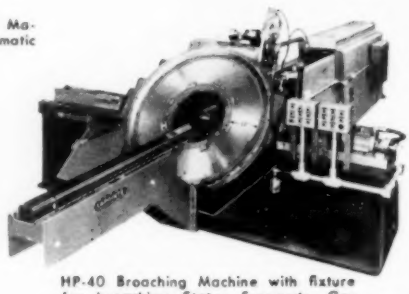
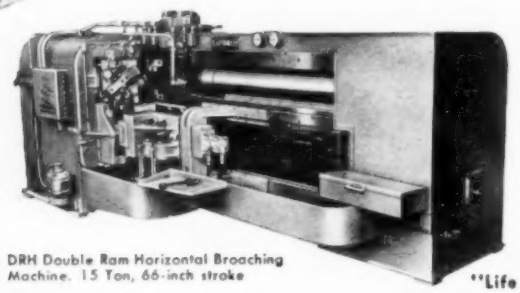


VU-3 Broaching Machine with automatic loading conveyor



HP-40 Broaching Machine with fixture for broaching Stator Segments, Gas Turbine Generator

DRV Double Ram Vertical Broaching Machine. 25 Ton, 66-inch stroke



DRH Double Ram Horizontal Broaching Machine. 15 Ton, 66-inch stroke

Write for the booklet, **"Life was like that . . . before Broaching!"** The old-time pictures of automobiles, agricultural machinery, aircraft, etc., indicate the progress made since 1902. Ask for Booklet D.

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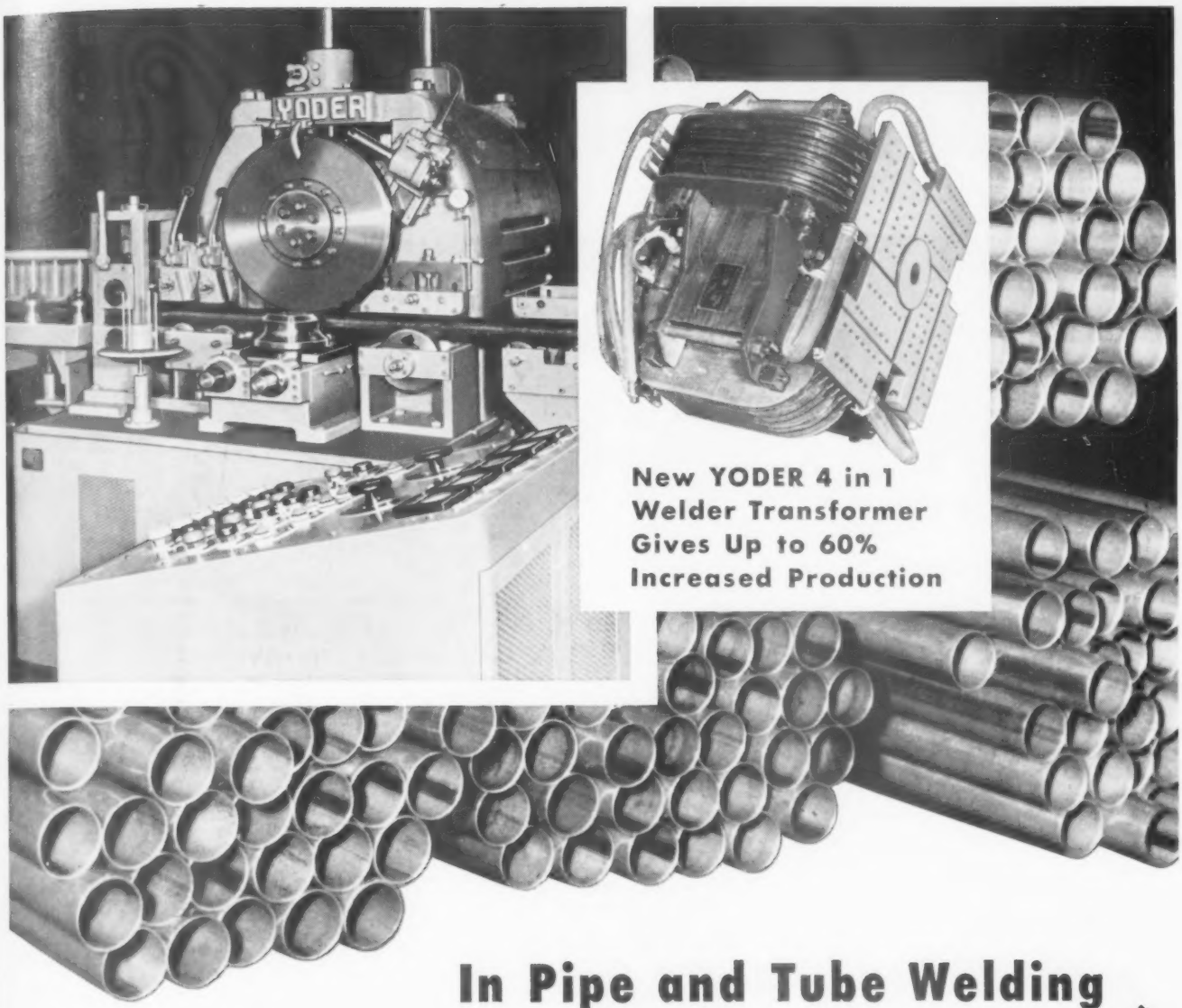

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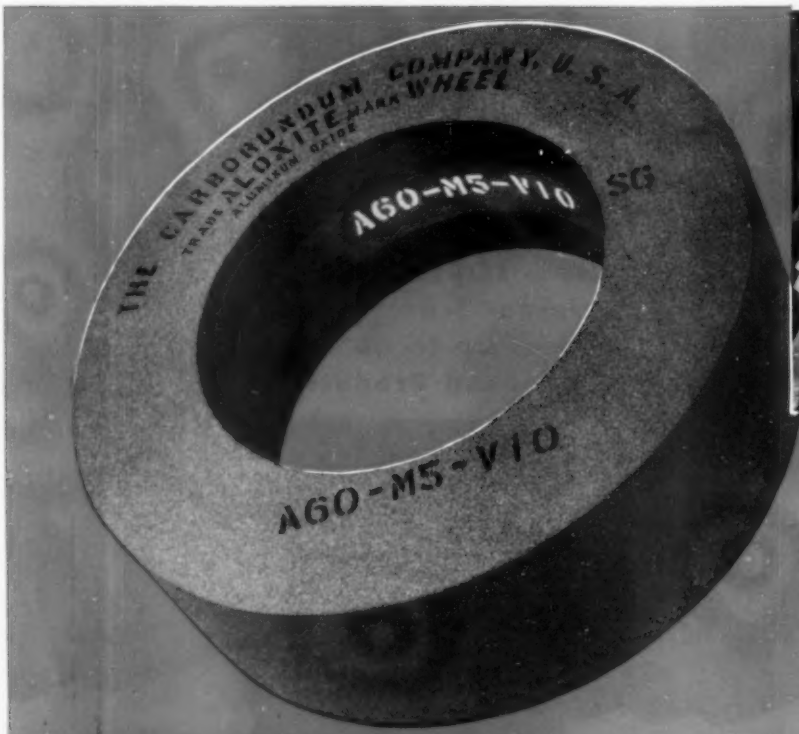
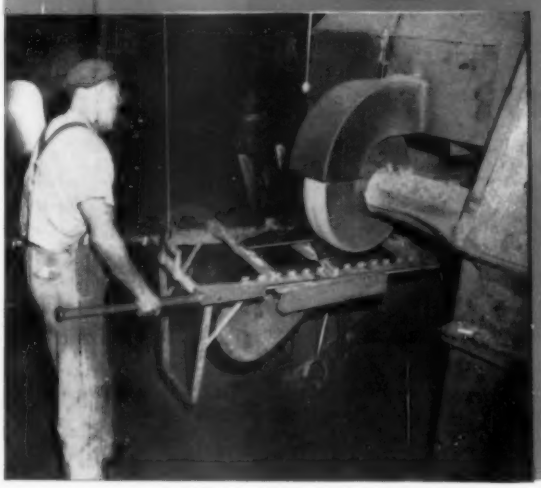
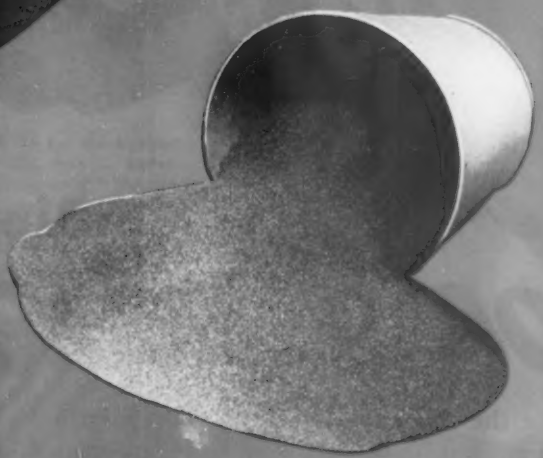


COOL, FREE-CUTTING qualities of improved V10 Bond **Grinding Wheels** by **CARBORUNDUM** produce dimensionally accurate work free from chatter marks, scoring or burning. Use them for heavy stock removal over the entire range of centerless work, throughfeed and infeed, on either hard or soft metals.





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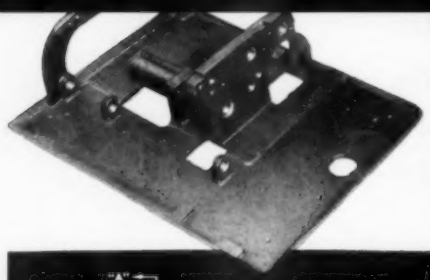
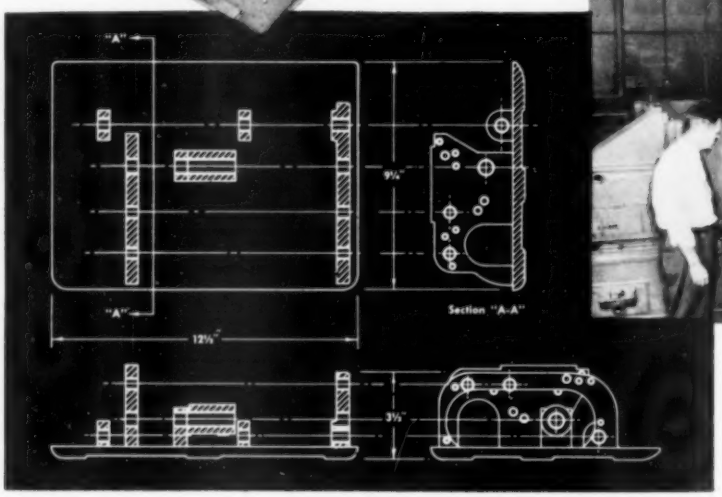
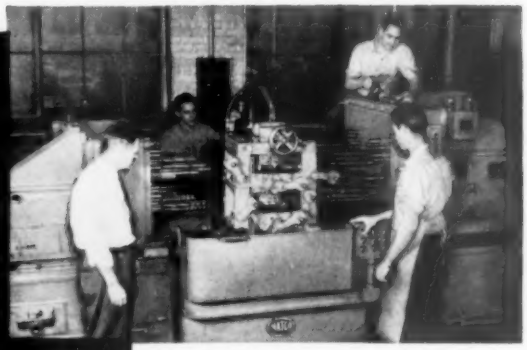


PART: DICTATING MACHINE FRAME

OPERATIONS: Drilling, rough and finish reaming, counter sinking and tapping 74 holes in this frame as follows:

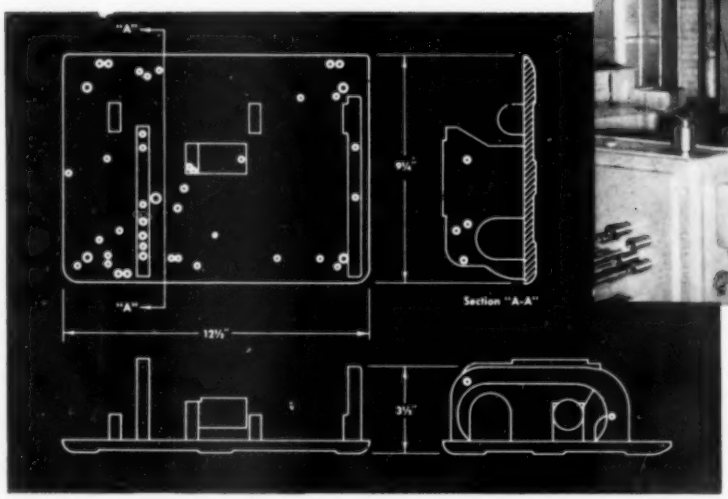




TWO-WAY NATCO HOLEUNIT MACHINE

Drills 25 holes; Rough reams 16 holes
Countersinks 13 holes; Counterbores 2 holes

Hole sizes range from 7/64" to 31/64"



LINE OF FOUR NATCO H6 HIGH SPEED, SENSITIVE DRILLING & TAPPING MACHINES

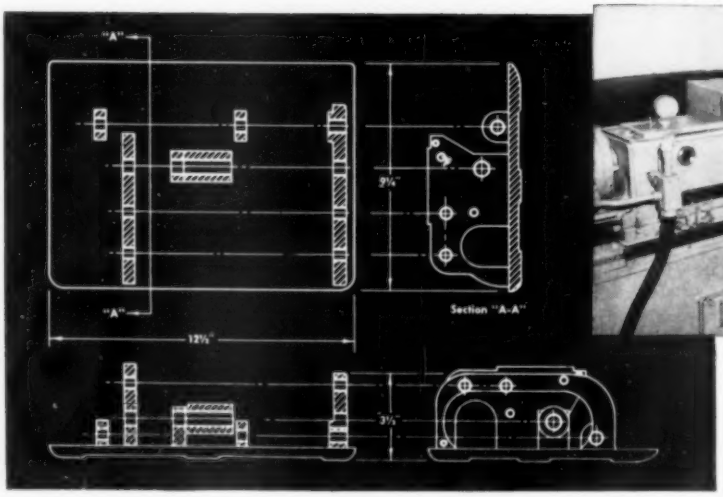
First Machine
Drills 17 holes
Countersinks 3 holes
Counterbores 1 hole

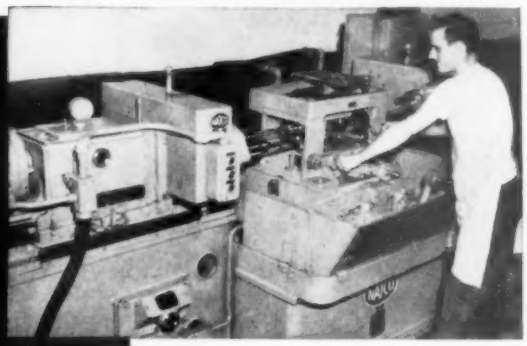
Second Machine
Drills 20 holes

Third Machine
Taps 19 holes

Fourth Machine
Taps 22 holes

Hole sizes range from 3/32" to 5/32"





TWO-WAY NATCO HOLEUNIT MACHINE

Finish reams 7 holes
Line reams 9 holes

Hole sizes range from 3/16" to 1/2"

Branch Offices

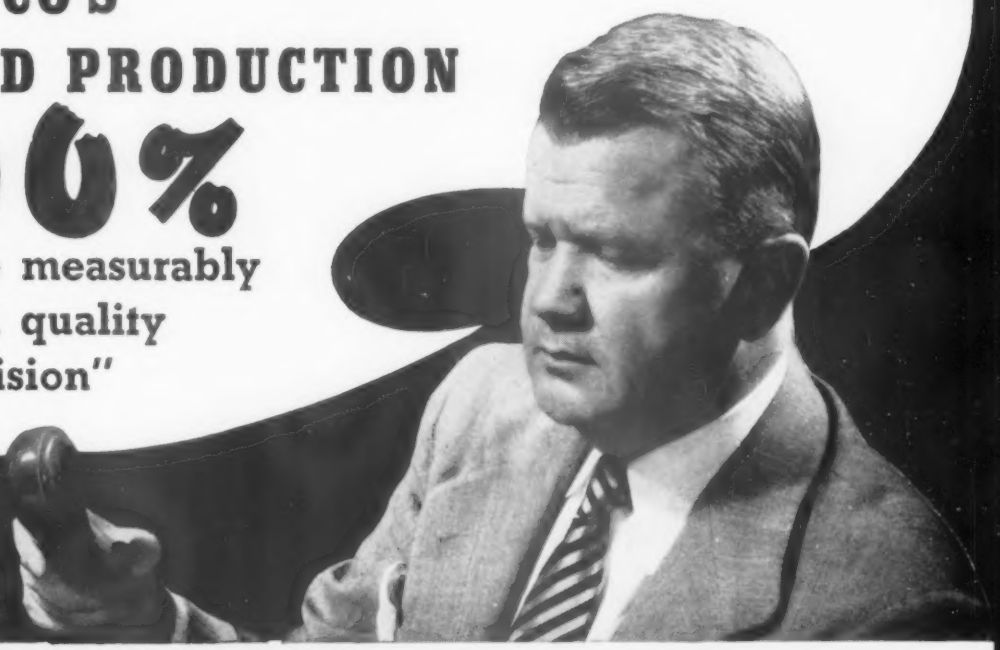
1809 Engineering Bldg., CHICAGO • 409 New Center Bldg., DETROIT
1807 Elmwood Ave., BUFFALO • 2902 Commerce Bldg., NEW YORK CITY

"We purchased six **NATCO** machines to boost production and to improve our products . . . the **NATCO'S**

INCREASED PRODUCTION

300%

and have measurably increased quality and precision"



and each **NATCO** machine is also arranged to perform similar operations on five other sizes of frames . . . another product made better, faster and at lower cost with **NATCO** machines.

(Write today for a complete case history)

Call a Natco Field Engineer

to help you solve your problems in Drilling, Tapping, Boring and Facing

NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Indiana

All Lufkin Chrome-Clad Micrometers now tapped on Warner & Swasey Tapping Machines

Warner & Swasey No. 11 Precision Tapping and Threading Machine in use at Lufkin Rule Company, Saginaw, Michigan.

THE NAME, LUFKIN, has long been associated with extreme accuracy by users of precision measuring instruments. However, many man-hours of selective assembly were required to assure such accuracy in Lufkin Micrometers—until Warner & Swasey helped simplify and speed up their production.

Now Warner & Swasey No. 11 Precision Tapping and Threading Machines tap the high precision threads necessary in the hub and in the thimble of the micrometer. They perform each of these tapping operations in one pass, where three were previously required. And Warner & Swasey's positive lead screw principle maintains an accurate and constant lead control in these threads. No longer must an operator "feel" his way into the work by hand, or risk damage to the finished threads on withdrawal.

But of particular importance to Lufkin, operators can now qualify the starting positions of the taps so the "zero" mark on the micrometer's thimble matches perfectly with the reading lines on the hub when assembled. This drastically reduces the time-consuming selective and individual fitting of thimble to hub formerly necessary.

Where your work requires extreme threading accuracy on a production scale, call in your nearest Warner & Swasey Field Representative. He'll explain the many unique features of the No. 11 Precision Tapping and Threading Machine, and show you how it can improve your tapping operations.

WARNER & SWASEY
Cleveland

YOU CAN MACHINE IT BETTER, FASTER, FOR LESS WITH WARNER & SWASEY TURRET LATHES, AUTOMATICS AND TAPPING MACHINES

POPE

LEADS THE PRECISION SPINDLE PARADE

POPE qualifies as your Spindle Department.

YOU name the type or size Spindle and specify POPE.

You get finer finishes and continuous, peak production of accurate parts.

The POPE System of lubrication provides permanent bearing lubrication and maintains the high accuracy of the Spindles longer because of their low operating temperature.

Send us your specifications and you'll get a prompt quotation on the best Spindle for your job.

No. 81

POPE

TRADE MARK REG. U.S. PAT. OFF.

POPE MACHINERY CORPORATION

ESTABLISHED 1920

261 RIVER STREET • HAVERHILL, MASSACHUSETTS

BUILDERS OF PRECISION SPINDLES

You can do 'most any job on a

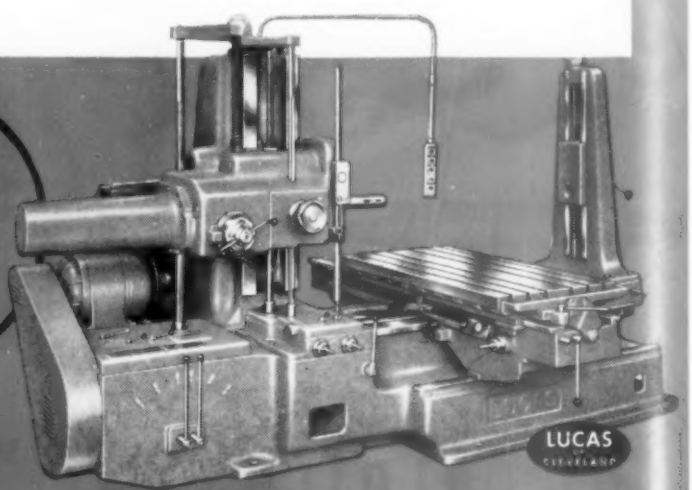
LUCAS

And . . . because you can do such a wide variety of operations on a Horizontal Boring Machine, it is today one of the most CRITICALLY NEEDED machine tools in the entire re-armament program.

The overwhelming demand for the LUCAS Horizontal Boring Machine, which embodies every important design improvement, many exclusive with Lucas, has built up a backlog of priority orders which make short time deliveries difficult.

Therefore . . . in appreciation of your preference for Lucas Machines, we gladly offer our services and suggestions on how better methods and improved operating practices can help you to step-up production on your present Boring Machine equipment until your new LUCAS can be delivered.

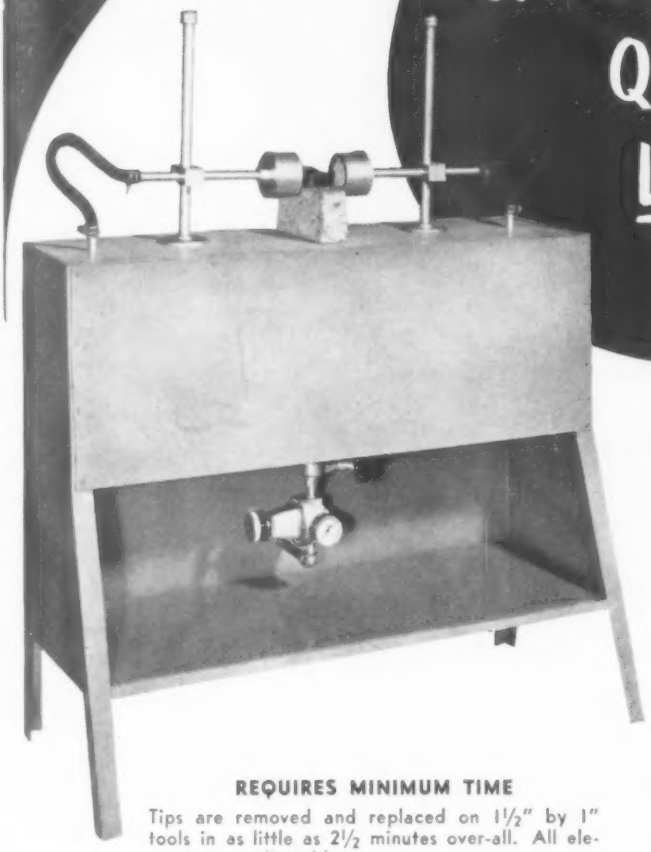
Automatic Power Positioning ★ Integrally cast 4-way beds with 4-point support ★ Complete range of feeds and speeds to one spindle ★ Pendant Control ★ Vibrationless V-belt drive to spindle at high speeds ★ Complete line of attachments ★ Chrome plated lead screws



LUCAS *Precision* HORIZONTAL BORING DRILLING AND MILLING MACHINES

LUCAS MACHINE DIVISION, THE NEW BRITAIN MACHINE CO., CLEVELAND 8, OHIO

REPLACE CARBIDE TOOL TIPS QUICKLY AT LOW COST



NEW TIP-BRAZING UNIT IDEAL FOR METAL WORKING SHOPS

Now — a safe, easy, economical way to braze carbide tool tips on tool shanks. This new tip-brazing unit is a low-cost investment for any shop and will soon pay for itself. Many already in use with proven successful results.

REQUIRES MINIMUM TIME

Tips are removed and replaced on 1½" by 1" tools in as little as 2½ minutes over-all. All elements are adjustable.

ECONOMICAL TO OPERATE

Uses 75 lbs. compressed air in combination with manufactured or natural gas at regular city pressure. No expensive electrical controls required. No complicated equipment to service or maintain.

GREATER ACCURACY

Refractory-cup radiant gas burners, supported by adjustable clamps, can be faced to within ¼ to ½ inch of tool shank.

SAFE, FOOLPROOF METHOD

No "blasting" over the tool because velocity of burning gases is largely dissipated within burner cup. No danger of flux being blown off at tool end before brazing is completed. Less inclination toward oxidation than other methods.

ATTRACTIVE — RUGGED — COMPACT

Modern, streamlined appearance. Requires only five feet of floor space. Sturdy construction to provide long, constant use.

EASY TO OPERATE

Few moving parts and simple operation make it easy for any workman to do the job without special training. Tool tips are easy to get at.

VERSATILE

Unit also ideal for annealing welding tools and heat treatment of small parts. A small oven can easily be adapted to the unit. Higher temperature bronze bond can be used rather than silver solder.

VALLEY MACHINERY & SUPPLY CO.
P. O. Box 434 Rock Island, Illinois

SEND TODAY FOR FREE CATALOG

VALLEY MACHINERY & SUPPLY CO.
P. O. Box 434, Rock Island, Illinois

Please send illustrated catalog on New Tip-Brazing Unit.

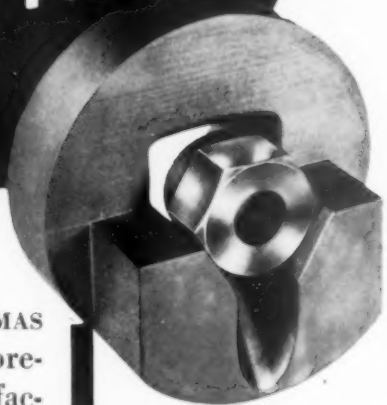
Name _____

Address _____

City _____ State _____

ELASTIC STOP NUT
CORPORATION OF AMERICA
REPORTS:

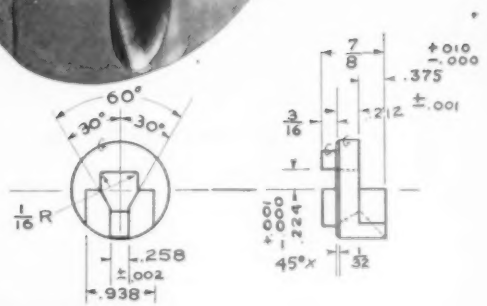
"5,250,000 NUTS AND STILL NO SIGN OF WEAR" WITH THIS SOLID ADAMAS CARBIDE WEAR PART



This is still another example of how ADAMAS solved an extremely difficult and intricate pre-forming operation that other carbide manufacturers considered impractical.

The pre-formed ADAMAS Carbide wear-part illustrated upped ESNA's tool-life by 200% to date with resulting decreased down-time and lower costs.

Your problem may be different—increasing tool life, machining a new metal, proper grade selection—and not at all like the pre-formed wear part produced by ADAMAS for ESNA. If it is, YOU CAN STILL BENEFIT by letting the ADAMAS Field Engineering staff . . . with their years of carbide experience . . . help you solve your problem.



OPERATION:
High speed drilling of a countersink in the seating surface or base of a steel nut on a Kent Countersinker.

BEFORE:
When oil-hardened steel was used as the orifice, only 1,750,000 nuts were produced before the steel tool was scrapped

AFTER:
By switching to ADAMAS carbide, 5,250,000 nuts have been produced to date—and still no sign of wear.

Send today for the NEW
ADAMAS CATALOG #A851

ADAMAS CARBIDE CORPORATION
100 South 4th Street, Harrison, N. J.
PRODUCERS OF TUNGSTEN CARBIDE TOOL TIPS, DIES AND WEAR PARTS

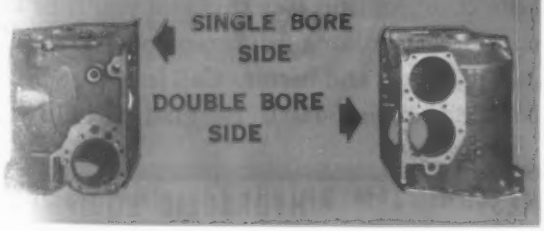
BAUSH TRANSFER LINEUP GIVES MAXIMUM PRODUCTION WITH A MINIMUM OF LABOR

Today Baush-designed multi-unit transfers are performing hundreds of operations automatically—one operator turns out the work of many—costs are held to a minimum and production is greatly increased.

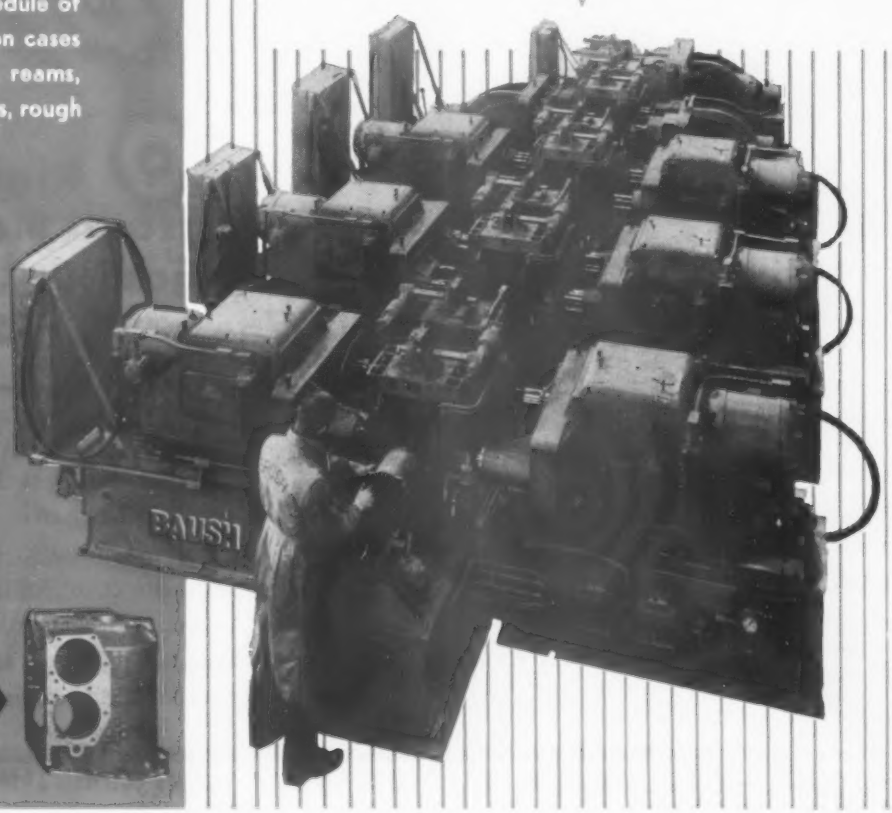
Why not send us your prints and specifications—there's no obligation and we may save you many costly manpower hours. Phone, wire or write us today.

The four 2-way horizontal and one (1) single way horizontal hydraulic machines—each with one (1) load and two (2) work stations, as illustrated, are a part of a complete transfer lineup designed to perform all machine operations on automotive transmission cases for a large Mid-West plant.

With a production schedule of 80 automotive transmission cases per hour this lineup drills, reams, counterbores, countersinks, rough bores, semi-finish bores and taps holes in both the single and double bore sides of case. Automatic turnover fixture is provided, prior to last machine in lineup, to index case into exact position for tapping all holes in bottom face.



BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS



HOW TO CUT TIME FOR SMALL LOT MILLING

Standard Rigidmil equipped with magnetic fixture. Note variety of work handled.

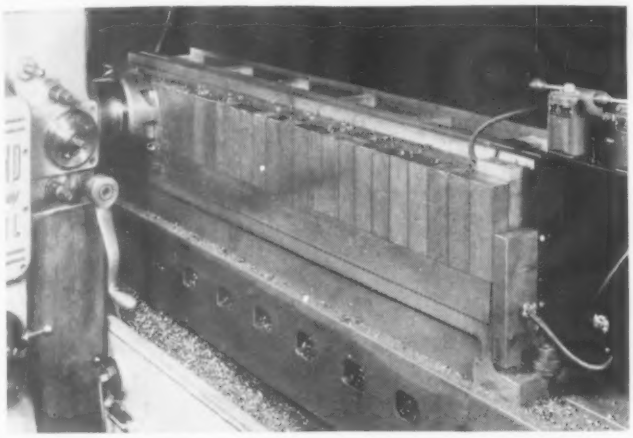
Standard Rigidmil With Sundstrand Magnetic Fixture Averages 50% Savings On Lot Sizes of 1 to 25 Pieces

If you want to cut costs and increase production on miscellaneous milling, investigate this excellent combination. It consists of a Sundstrand Standard Rigidmil equipped with a Sundstrand magnetic fixture. Parts machined in this installation include tool blocks, cam bars, tool slides, motor brackets, etc. Lot sizes vary from 1 to 25 pieces, and time reduction averages 50% over former method. In addition to saving time through the elimination of mechanical clamps, these magnetic fixtures save the cost of special jigs or fixtures. Install a combination like this and you'll be surprised at the number of different parts you'll be able to mill faster and better. Call in a Sundstrand methods engineer. He'll be glad to help you.

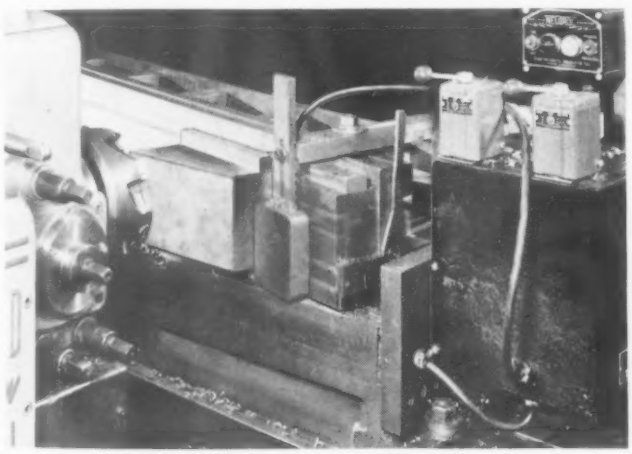
SUNDSTRAND

RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT

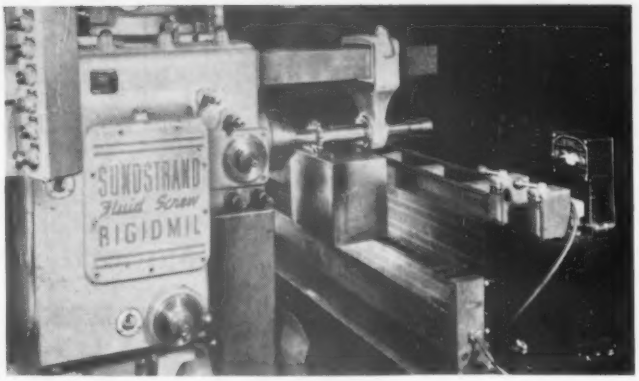
5 TYPICAL SET-UPS



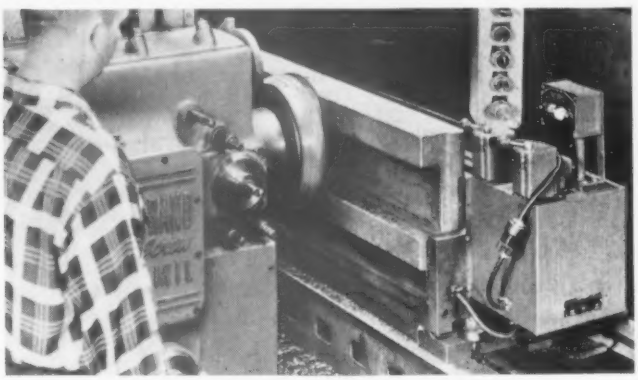
Twenty-five pieces of cold rolled steel are held in the fixture for this milling operation. Feed rate is 17″ per minute and depth of cut is 1/8″.



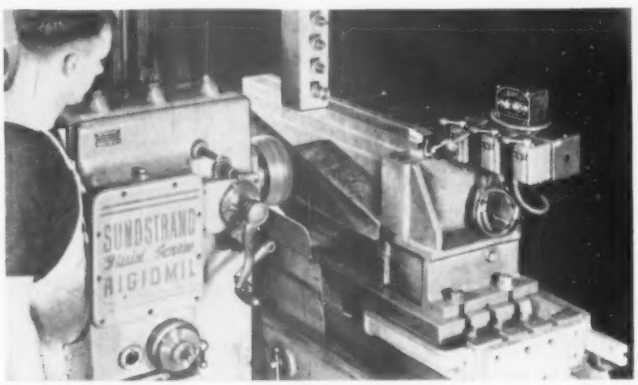
Holding steel tool block for milling angular top face. An 8″ dia. carbide tipped cutter takes a 1/4″ deep cut at 14″ per minute feed rate.



Milling 1/2″ wide by 1/4″ deep slot in steel tool block at 4″ per minute feed rate.



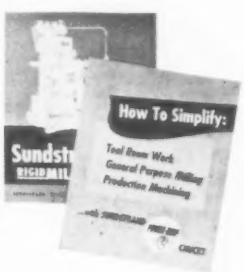
A 12″ carbide tipped cutter is used to mill this cast iron part at 8″ per minute feed. Depth of this interrupted cut is 3/16″.



This cast iron part is milled on all sides. The feed rate is 10″ per minute and depth of cut is 3/16″.

Get This FREE Additional Data

For complete information on standard Sundstrand Rigidmils, write for bulletin No. 715. For more information on Sundstrand Magnetic Fixtures, ask for bulletin No. M-715.



SUNDSTRAND

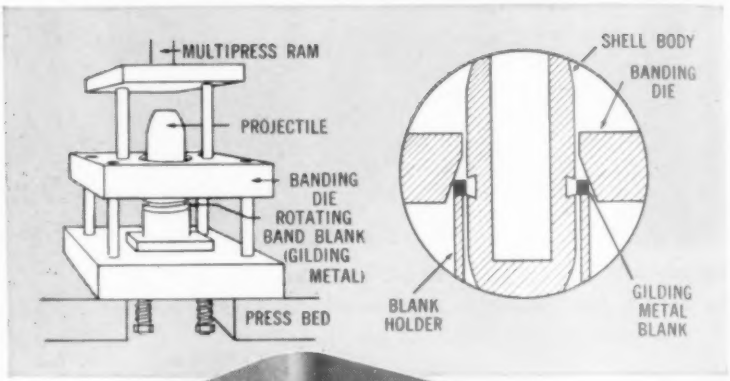
SUNDSTRAND
Machine Tool Company
2540 Eleventh St. Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES

FASTER SHELL BANDING

Proof again that you get better results on an amazing range of jobs, with the oil-smooth speed and *power control* of

MULTIPRESS®



At speeds up to double those attained by other methods today, the Multipress at right brings new precision to shell-banding operations.

Combining its rapid, fully controlled "continuous squeeze" action with a tapered, solid die, Multipress assures uniform metal flow in contracting banding rings . . . reduces chance for metal fracture . . . eliminates work-hardening of metal . . . provides uniform radial pressures around the entire band . . . leaves no parting marks as dies are raised. In addition, the Multipress equipment requires less space than most other shell-banding equipment.

This new Multipress shell-banding process is applicable to projectiles of almost any size. Quick, easy tool changes adapt the press shown here to 20mm, 75mm, 76mm, 90mm, 105mm, 120mm and other shell sizes.

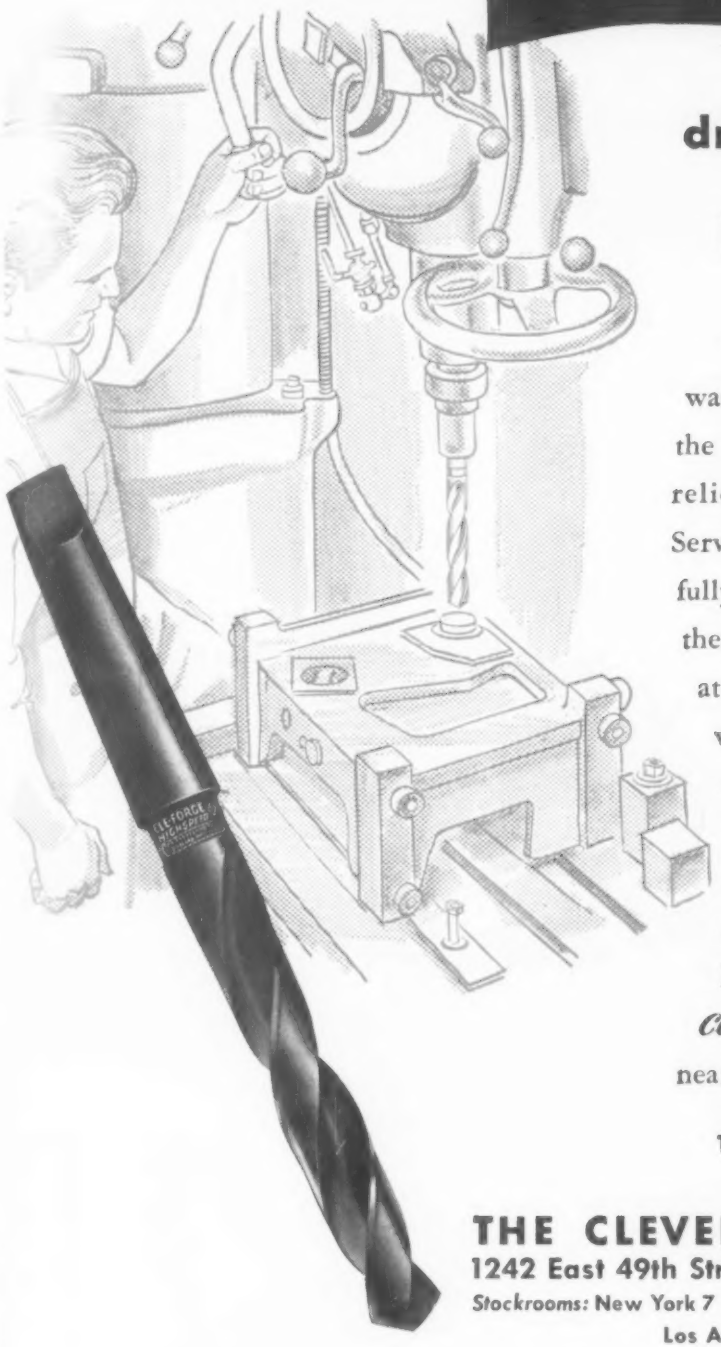
QUICK CONVERSION — to an enormous range of jobs calling for accurate speed and pressure — is an established Multipress advantage. Eight frame sizes can be equipped for almost any ram action or operating sequence. Manual or automatic controls. Automatic Multipress Index Tables and other accessories available for special needs. Capacities from one ton to fifty tons. Write for full details.

The DENISON Engineering Co.

1158 Dublin Road,
Columbus 16, Ohio

DENISON HydrOILics

NOW... ONE PASS

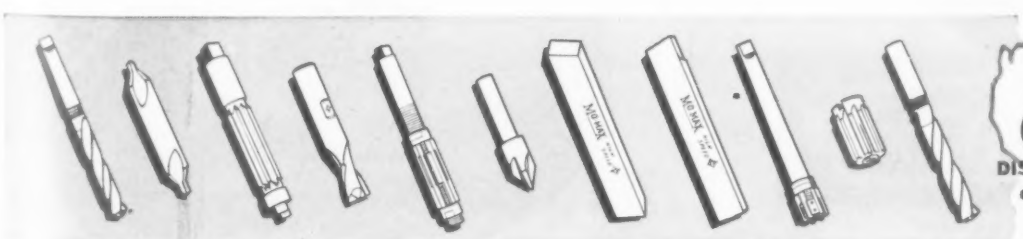


drills hole 3½ in. deep in 18-8 stainless steel

This was a slow and difficult job. There was considerable tool breakage, even though the operator made several pull-outs for chip relief on each hole. ◈ When a *Cleveland* Service Representative was called in, he carefully analyzed the set-up . . . and recommended the CLE-FORGE High Speed Drill illustrated at the left. This is a stock drill with a heavy web, and with flutes designed for easy chip removal. Now—because of the greater strength and rigidity of this drill—the deep holes are drilled in one pass. Breakage has been greatly reduced. ◈ Whenever *you* have a drilling problem, get the advice of a *Cleveland* Service Representative. Contact our nearest Stockroom, or . . .

Telephone Your Industrial Supply Distributor

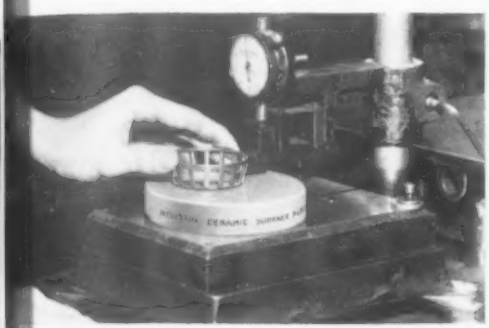
THE CLEVELAND TWIST DRILL CO.
1242 East 49th Street **Cleveland 14, Ohio**
Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5
Los Angeles 58 • London W. 3, England



ASK YOUR INDUSTRIAL SUPPLY DISTRIBUTOR FOR THESE AND OTHER *Cleveland* TOOLS

NORTON
Ceramic
Surface Plates
They're Flat!
and stay flat!
They're S-m-o-o-t-h!
They're Wear-Resistant!
Won't Corrode!
They're Easily Cleaned!
Non-Magnetic!

Better Buy Norton
Ceramic Surface Plates



We've no doubt you will find a ***"carnival"*** spirit in plants pleased with the performance of Norton Ceramic Surface Plates.

These ceramic surface plates are ***"headliners"*** in their own right. You can shout about them with enthusiasm. And you know that you're not cheating anybody — for these ceramic surface plates are certainly worth every penny that they cost — and more!

As a matter of fact, in plant after plant, Norton Ceramic Surface Plates are paying for themselves by their extra-long, trouble-free service. The reason? Because they are made of one of the hardest substances known. This gives them a wear-resistance which shows off to best advantage on your severest production gaging and blueing operations.

Another feature attraction of Norton Ceramic Surface Plates is the new precision standard of continuously smooth finish given to their surface. This permits easy movement of instruments and work across the plate without excessive drag and without vibration. This precision flatness prevents wear of expensive instrument bases, gage blocks and sine bars.

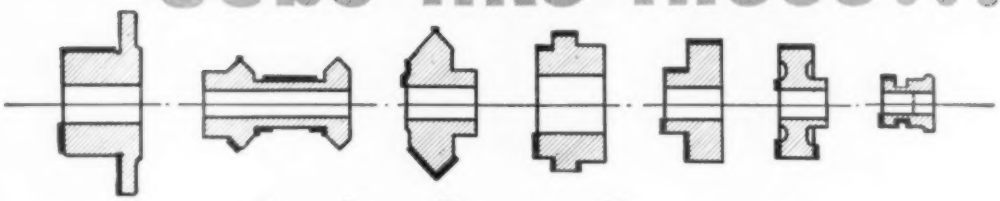
All your inspectors will shout about the easy-to-use Norton Ceramic Surface Plates that neither sweat nor corrode — that never require greasing or protection from moisture — that cannot warp or deform, or give expansion troubles, or deflect under load because they're made of a durable and stable material.

Hurry! Hurry! Hurry!
If you're in a hurry for these best of all surface plates, order today from your nearest Norton distributor or write directly to us. Norton ceramic surface plates are available from stock in diameters from 5" to 24".

NORTON

NORTON COMPANY, WORCESTER 6, MASS.
DISTRIBUTORS IN ALL PRINCIPAL CITIES
DISTRICT SALES OFFICES: New York 6 Philadelphia 44 Pittsburgh 23 Cleveland 3 Detroit 8 Chicago 32

Jobs like these...



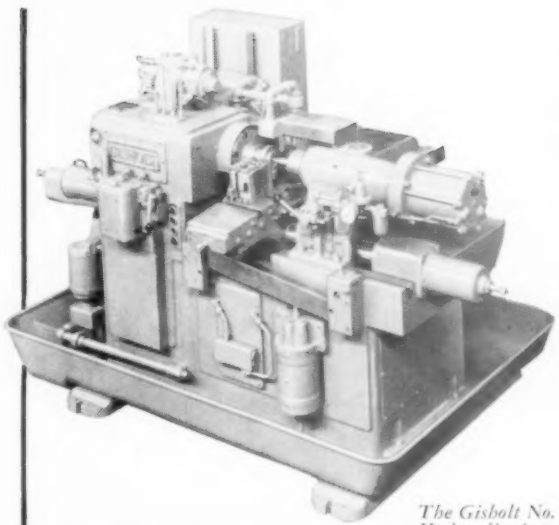
on a Job-Lot basis...

on Automatic Lathes?

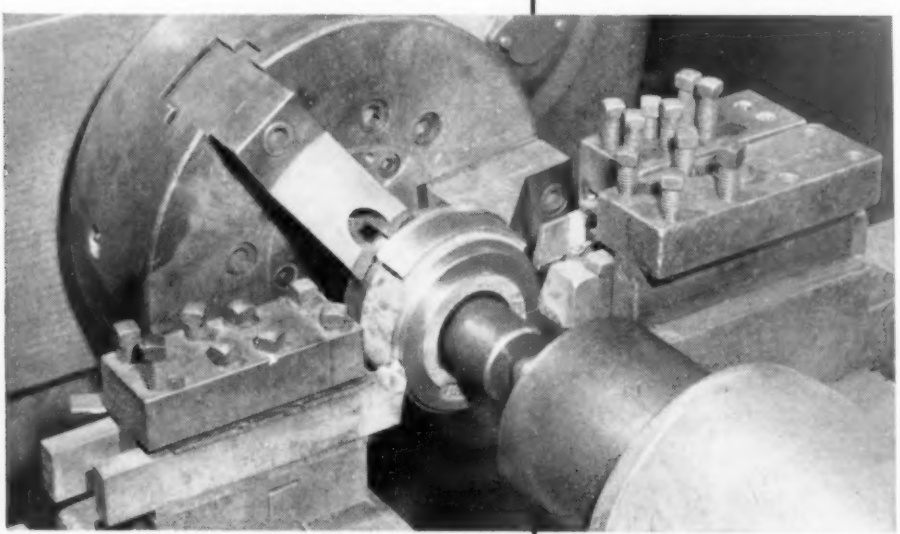
Absolutely! And these are only 8 of over 200 actual small-lot jobs handled on Gisholt No. 12 Hydraulic Automatic Lathes. The Crompton and Knowles Loom Works of Worcester, Mass., has *four* No. 12 Hydraulics busy producing and saving on work like this . . . and all with standard tool blocks!

Job-lot work like this—and like yours—is a natural for the No. 12 Automatic. The cost is no more than a hand-operated lathe for work this size . . . yet you have the added advantages of automatic machining and one-man operation of two or more machines.

If you have contract work like this, now or pending, it will pay you well to get the facts on the No. 12 Hydraulic Automatic Lathe. There's a big 24-page catalog free for the asking.



The Gisholt No. 12 Hydraulic Automatic Lathe gives you speed and accuracy plus *easy set-up.*



GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

Starrett

FRICTION THIMBLE* MICROMETERS

Give You

- UNIFORM PRESSURE
- UNIFORM READINGS

Every Time

Starrett
"SATIN CHROME"
MICROMETER No. 231-F

With Friction Thimble Range 0-1" by .0001", shown above. Friction Thimbles also available on other sizes and styles.

*An improved ratchet stop mechanism built right into the thimble permits easy one-hand operation of the micrometer . . . insures uniform contact pressure on every measurement. *Friction Thimble* puts the ratchet stop mechanism "right under your thumb" where it's easy to reach, easy to *use*. You get the same sure accuracy every time independent of "feel". *Friction Thimble* is an ideal feature for inspection and quality control applications and for all precision work requiring consistent accuracy. Ask your Starrett Tools distributor to show you Starrett Micrometers with *Friction Thimble* . . . plus 12 other big Starrett features including Satin Chrome Finish, Tapered Frame, Hardened Threads ground from the solid and stabilized and Hi-Micro Mirror-Lapped Finish on contact faces.

STARRETT TOOLS

TRADE MARK
Starrett
REG. U.S. PAT. OFF.

SINCE 1880
WORLD'S GREATEST TOOLMAKERS

THE L. S. STARRETT COMPANY · ATHOL, MASS., U.S.A.

BUY THROUGH YOUR DISTRIBUTOR

MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS
DIAL INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK
HACKSAWS, BAND SAWS and BAND KNIVES

Production News

ABOUT *Lusol*.. —THE ALL-CHEMICAL METAL-WORKING SOLUTION

FROM F. E. ANDERSON OIL COMPANY · PORTLAND, CONNECTICUT

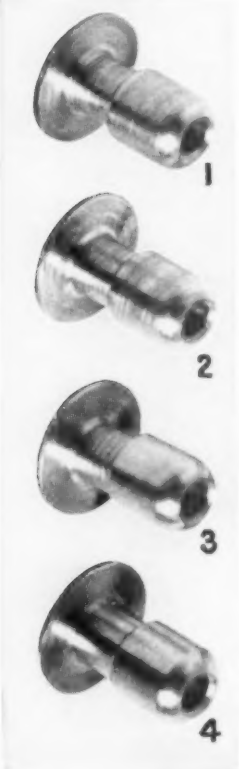
Lusol Outcools, Outproduces All Other Coolants

You can get far greater production from your shop, and you can do it without adding a single machine or tool or man, simply by switching to Lusol. You can prove these facts about Lusol to your own satisfaction in your own plant—just as thousands of others have already done.

Lusol is a clear, all-chemical concentrate that is diluted with water and used in the coolant system of almost every type of machine tool—lathes, grinders, milling machines, saws, broaches, even rolls and presses. In each of these operations we have cases of increases in tool life as high as 500% and even higher. Less down time for tool dressing means greater production. Work stays cooler because Lusol is a super-coolant. Oilless Lusol reduces the surface tension of water so it penetrates to the very cutting edges of the tools, keeps grinding wheels from loading up.

Workers like Lusol! A mild combination of chemicals, milder than most toilet soaps, Lusol by itself can't become foul smelling or cause dermatitis. Workers' hands, clothes and the surrounding floors stay clean and non-oily. Frequently, parts made with Lusol need not be degreased before painting, plating or assembly. While not a rust preventive, Lusol reduces the possibility of rust on parts that are stored between stages of production.

★



Lusol increases speed, improves finish on aircraft fastener job!

The parts at left are fasteners for supersonic aircraft (shown about twice actual size). They are made of 2317 nickel steel, turned on a No. OOG Brown & Sharpe automatic screw machine.

Part No. 1 was run with a sulphur base cutting oil. The finish was poor and the cycle slow (49 seconds). Increasing the speed burned up the tools. A switch to Lusol, diluted 30 to 1, at the same feeds and speeds, gave no better finish (see Part No. 2). Then the cycle was increased from 49 to 33 seconds and the finish improved, as shown on Part No. 3. Increasing the spindle speed from 1600 to 2250 rpm, machine cycle of 33 seconds, gave an exceptionally fine finish, as shown on Part No. 4. Tool life was lengthened considerably.

users say*

case histories of Lusol at work

A CONVEYOR MANUFACTURER—"8,000 forged steel brackets produced per broach grind with Lusol in the machine, compared to the previous 3,500 pieces. Doubled production and less down time for changing broaches for resharpening."

A FARM EQUIPMENT MAKER—"Have had outstanding success on deep drilling in balancing crankshafts. Drill 7/16" holes and, where we could only go 2½" deep, we now go as deep as 3½" with Lusol."

A SUBCONTRACTOR—"No greasiness on the finished parts, so we bundle them for shipment just as they come off the machines. Some have to be given a prime coat of paint; we simply wipe them off with a cloth and then spray them."

A CRANKSHAFT MANUFACTURER—"We wash $5 worth of grinding wheel down the sewer every time we dress a wheel. Since we adopted Lusol for our entire grinding department, we've saved an awful lot of money by reducing the number of dressings our wheels require."

*Users' names furnished on request.

FREE BOOK

Get complete facts about Lusol by writing for this 20-page booklet. It contains information on machine cleaning, maintenance of Lusol solutions, elimination of dermatitis and odor in machines, plus many case histories of Lusol at work. Write F. E. Anderson Oil Company, 213A, Portland, Conn.

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THE TOOL ENGINEER
Publication of The American Society of Tool Engineers

The **Tool Engineer**

a Letter from the Editor...

Two studies we've planned for the March, 1952 issue of *The Tool Engineer* are of considerable importance to most tool engineers individually, as well as to our profession.

The first is a survey of various manufacturers' policies with respect to research in some of the phases of tool engineering. Many tool engineers have expressed their need for continuous, permanent facilities and financial support to permit investigation into proposed changes in processes, machines, tooling, plant layout and other fundamentals of manufacturing. Some leading corporations have adopted the philosophy that as research on new products is carried out on a formal scale, the dollar amounts involved in tooling and production certainly justify setting up a similar program for tool engineering research, as opposed to the common practice of initiating study on a specific project for a short time, with charges written off as overhead and no permanency to the operation.

The second is a study of the tool engineer's influence on the development of modern machine tool designs—his suggestions, demands, innovations which have gone far to bring about our present level of productive equipment.

Both of these studies strike close to home for thousands of tool engineers. Both suggest personal experiences which collectively are important. The point of this letter is an invitation to you to write me about your experiences in each of these two categories. On the first, I'd like ideas pro and con—as specific as possible, with dollar amounts lost or gained mentioned as well in your letter.

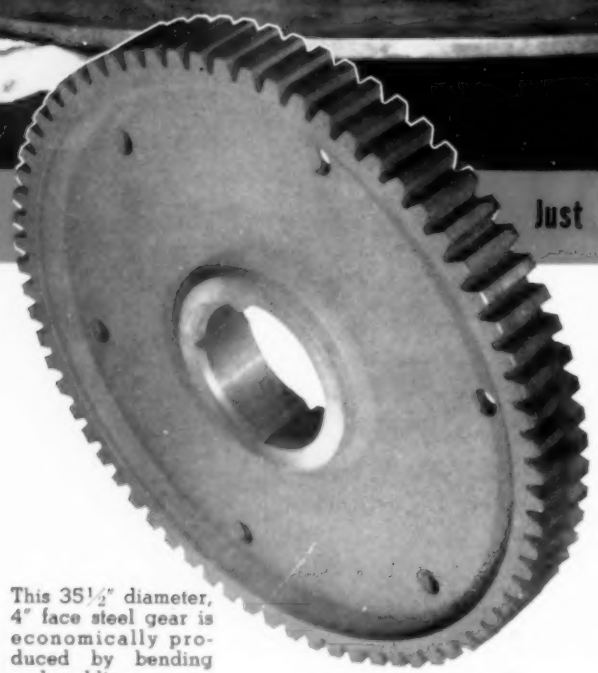
In the second category, I'd like to hear of your experiences in development of tools and machines, working with builders to bring about a different tooling approach, a combination of operations, or a change in process. To underline that your letter should be by return mail, we'll forward a five-dollar check for each comment (with or without your byline) which we can use.

Gilbert P. Muir

GIANT GEAR RIMS

Wedge action die for bending rings in horizontal position. Removable inserts adapt this die for various diameters.

Just another job for versatile CINCINNATI PRESS BRAKES



This 35½" diameter, 4" face steel gear is economically produced by bending and welding.

This steel gear rim is completely formed from flat bar to ring in less than two minutes by repeated hits on a Cincinnati Press Brake.

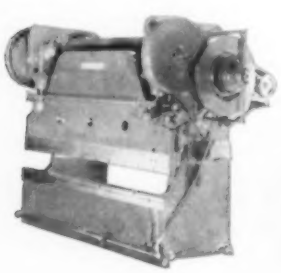
The wedge action dies require but little tonnage to bend this 2" x 4" hot rolled 35-45 carbon steel bar.

The great versatility of the Cincinnati Press Brake eliminates the need for an additional and highly specialized machine on this small-run job.

Low cost and quick changeover from job to job are among the factors that will make Cincinnati Press Brakes profitable in your shop.

Write for Press Brake Catalog B-3.

Contact our Engineering Department, who will suggest and advise on your production problems.



THE CINCINNATI SHAPER CO.

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The Tool Engineer

Editorial

Let's Drop the Dismality

Nineteen fifty-two offers a lot of possibilities, many of which look pretty grim. A substantial number of us believe that a large-scale war is around the corner. Our construction of a military machine will be much more apparent as hundreds of plants are tooled for defense production, and for those of us in civilian production the materials and tooling pictures are not overly encouraging. Certainly the cost of this great war machine is tremendous, and fears for the solvency of our nation are once more expressed.

All in all, it can be a frightening future. But it need not be. Taking our barrage of propaganda-for-behind-the-Iron-Curtain literally for a moment, we still have more luxuries of life than any other nation in the world. No reasonable man will argue that our personal and corporate taxes are trivial, but nevertheless our taxes, compared with the earning possibilities in this country, and considering the pleasures of living in the United States, don't stack up too badly in today's world.

We might have a little trouble getting the brand of Scotch we want upon occasion, but it's a lot better than having our nation's entire output shipped abroad. And if beef seems high, we might investigate our own part in the pros and cons of the controls battle that dates back to the mid-forties.

And when we wonder about sending our tax check direct to Washington to make sure it gets there, it might be worthwhile to consider what we've done personally to support the cleaning up of numbers rackets or gambling casinos around town, or the times we've tossed on a little pressure when a summons seemed imminent for our stack of ignored traffic tickets.

And we still have a chance to make a fairly decent living—and people are getting ahead and piling up reasonably good estates. Not as much as the glorious days of the nineties, but nobody ever figured out a way to take it with him, either.

All of which is one man's way of saying during this season that we might be reasonably well off, after all, and there might be a few things we could be downright thankful for.

J. Smith

PRESIDENT
1951-1952

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Quality Control of Job Lots

By Dorian Shainin

CHIEF INSPECTOR
HAMILTON STANDARD DIVISION
UNITED AIRCRAFT CORPORATION

Part I

"STATISTICAL QUALITY control is fine for high production rates, but I operate a job lot shop. I do not make enough of each part to warrant such complications. Charts based on the laws of chance might apply to the other fellow—not to me."

While it is true that a different emphasis has to be placed upon the use of quality control in a job shop, the people in more and more plants of this type are finding that quality control, in both the statistical and nonstatistical phases, can be of tremendous value. A job shop usually has many more applications that are potentially profitable.

In a production shop it is quite understandable that the aim is to improve the existing machines, designs, tolerances, gages and acceptance methods to secure better quality of the same items of product run month after month. Decisions at executive levels usually are responsible for bringing about such improvements.

In a job shop many more details have to be studied. The methods of processing drawing changes are studied after perhaps trying to narrow down the spreads of machine capabilities.[1]* Methods of allocating jobs and issuing and checking tools and gages can be improved. Setting uniform incentive pay rates and the periodic inspection of machines to maintain the quality of the many items turned out on universal equipment may also be involved. But it will be found, as Dr. J. M. Juran so aptly put it, "The basic quality problem is to strike the optimum balance between the cost of quality and the value of quality for each quality characteristic, and to do so in the lower levels of organization."[2] In the typical plant the facts as to the cost of quality and the value of quality are widely scattered throughout the organization. Of necessity, people at the lower levels have to take care of these details when so many different jobs are scheduled each month. Someone down the line is the one who is expected to think of a solution to such a problem as controlling saw slot widths in screw heads: measure the width of the blade instead of continually gaging samples of the product itself.

All this leads to the need for defining quality. It was previously stated[3] "Quality is not perfection, in terms of exact reproducibility of dimensions, finer surface finishes, extra strength, etc., at which control is aimed. Rather it is a minimum overall cost (considering cost of production, control, scrap, rework, service adjustments, good will) that is the goal and that establishes the risk levels for the design of the quality control plans to be employed."

Two Kinds of Quality

Particularly important to this problem of job shops is that there are two kinds of quality. The quality of design, often called grade; a Cadillac versus a Chevrolet—and the quality of conformance, the precision with which the product conforms to the design; in this respect the Chevrolet may be as good or even better. Fig. 1 illustrates the economics of quality of design. Level 2 shown on the horizontal scale is the most economical quality. If we were to drop back to Level 1 it would be found that the value of quality (market value) has been reduced by a greater amount than the reduction of manufacturing cost. On the other hand, going forward from the optimum quality, it will be noted that the gain in value of quality is much more than offset by the increase in cost of quality. Fig. 2 pictures the economics of quality of conformance. The total cost curve with its attractive minimum point comes from adding at any given levels of quality of conformance the three costs shown, those of manufacturing, quality control and

*Numbers indicate references given at the end of the article.

loss due to defectives. To the extent, then, that the positions of these curves can be computed from data in our shop, a quality of design and the quality of conformance that might approach optimum conditions can be found. At this point many job shop operators can probably visualize that a few trial studies along these lines may reveal a virtual gold mine. It might pay to organize people to collect operational and sales data to show the changes which will bring each product to the general vicinity of the optimum points. The cost of quality figures will be easier to estimate than those for the value of quality, which involves such things as good will and extent of service adjustments.

Scrap Allowances Must Not Be Exceeded

Exceeding the scrap allowance can be quite disconcerting, especially when the procurement of replacement castings, forgings or other raw material calls for a long delivery date. A particularly high unit cost can also follow because it may be necessary to set up to make just a few more pieces. The solution to this problem is not to simply order more material originally, but to use the particular form of quality control that might be adapted to

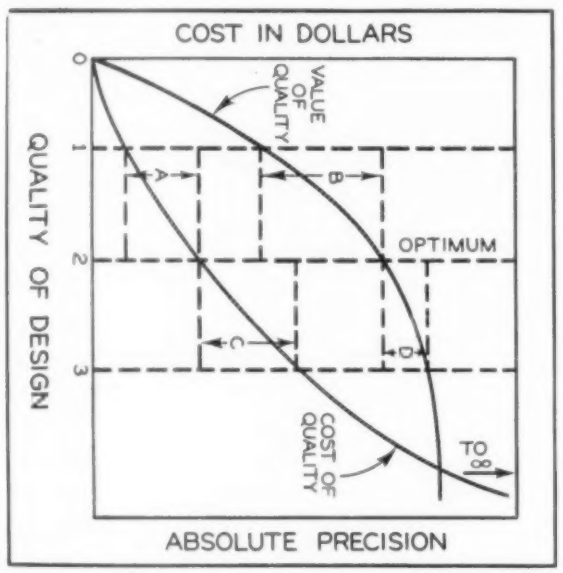


Fig. 1. Quality at Level 2 is the most economical. Dropping back to Level 1 reduces the cost by *A* but reduces the value by *B*. Rising to Level 3 increases the value by *D* but increases the cost by *C*.

minimizing the amount of scrap.

The required procedure, which recognizes that all operations have inherent and unavoidable variations, may be broken down into these steps:

1. Determine from initial results that the machine is set properly—this is more than a first piece inspection.
2. Provide a guide for the operator so that he can see whether his machine is continuing to "aim" for, or average out to the proper setting.
3. Have a method for determining early in the process whether the capability of the machine to hold size is equal to or less than the specification requirements.
4. Encourage the operator to use his control chart in such a way as to detect, before trouble occurs, that it is impending.

The Fallacy of First Piece Inspection

If the first piece following a setup measures within specification limits, it simply means that only some of the future production work can be expected to be acceptable. The variability inherent in any process has been completely ignored by depending upon one piece. Because it is impossible to make two pieces exactly alike, more than one piece must be measured to be able to estimate how much variation is inherent in the process. Even two or three pieces are not sufficient to give a reliable enough value for this inherent variability. The statistical tool to use here is called a Reset-Run Card.

Provided there is an estimate of the inherent variability of the machine from a previous run, it will be possible to select one of nine preprinted cards to do the job of determining whether the process is set correctly for any future run. This estimate based on past data, incidentally, comes very easily from another statistical tool, the quality control chart, to be described shortly. The first Reset-Run card in Fig. 3 shows a process that was found to be set correctly after six successive pieces were measured. The lower card comes from another example. The machine was found to require resetting after four successive measurements were punched out.

The measurement for each successive piece is marked with a ticket punch in the card at so many lines above or below zero for the first piece; so many lines above or below the previous hole for the second piece; and in like manner for succeeding pieces to give an accumulative reading. Lines on the indicator gage correspond to the lines on the card. When the boundary line in the region marked *Run*, or that marked *Reset* is reached by the successive holes, the last of which gives the net or algebraic sum of all readings, the measuring stops. Holes entering the *Run* region indicate that the process is set sufficiently close to the desired setting so that it is not necessary to take any additional readings. When entering the *Reset* region, it will be seen that a number is punched out. This number stands for an indication of the amount

that the machine is actually set away from the value that corresponds to zero on the indicator. Numbers above the center stand for work that gives too high indicator readings. Those in the lower half of the card reveal a correction needed in the other direction.

While this is what the practical man wants to know about the procedure, the statistical quality control engineer will be interested in more information. These preprinted cards are designed for a risk of ten percent of giving a *Reset* reading for a perfect setting; ten percent of giving a *Run* reading when the actual setting is either one standard deviation too high or too low from the desired setting. In other words it is 90 percent certain that a perfect setting will be approved and that one, off by one standard deviation, will be rejected. These risk levels have proved to be the most practical balance between precision and economy. It is, of course, a straightforward matter to calculate similar Reset-Run cards for other risk levels by this method of sequential acceptance sampling by variables.

Aiming Tracer Bullets at Precalculated Limits

The simplest but yet most effective control chart is a sum and range chart. It has two sections, the top one indicating the successive sums of the readings from each sample of three pieces. The bottom section represents the range values, each being the difference between the largest and smallest reading found in a sample. A practical estimate of the capability of a process needs a minimum total of 30 pieces (for ten successive samples of three pieces). When a job is to be set up for running, the measurements from the first 20 or fewer pieces will give a result on the Reset-Run card just described. That will indicate the adequacy of the process setting when consideration is given to the indication of the actual setting (either *Run* on the card or a punched-out number for the setting distance from *Zero*) in comparison to the tolerance specified for the product. These same readings can be plotted on a sum and range control chart.

While control limits are not yet available until the 30 pieces are recorded, other limits can be calculated on the chart before any production to serve as a guide for the operator as he plots his first ten samples. These limits will stand for the widest variation that can be allowed for sums and ranges to keep the individual pieces just within specification limits. They should be discarded after the proper control limits representing the actual capability of the process have been determined.

To illustrate the computation for the precalculated limits, take an example of a tolerance requirement of 0.005 in. Since the sample size is three pieces, the maximum inherent variation of

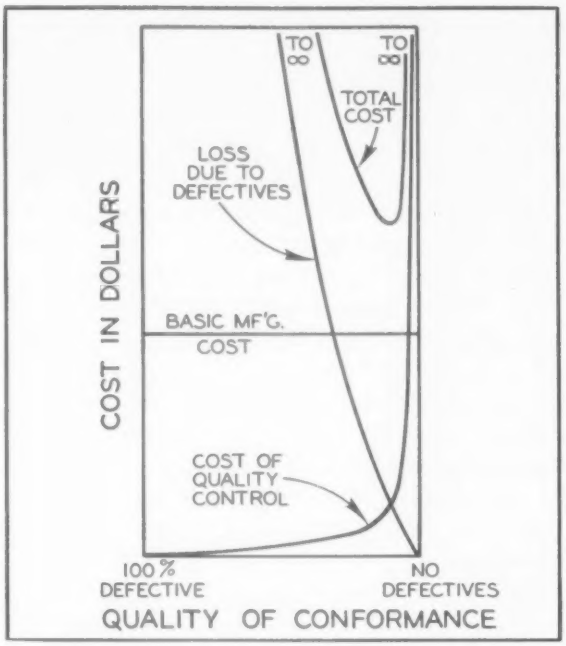


Fig. 2. Economics of quality conformance.

averages of the sample which can be tolerated will be 0.005 divided by the square root of 3 (1.73). This result, 0.0029, must now be multiplied by the sample size, 3, since the variation of sums will be exactly three times as large as that of the averages. The total allowable spread is now 0.0087.

This spread will be distributed half above and half below a mean value for the sums, which will be computed from the zero setting of the indicator or gage. If the gage, for example, is set to read zero for a value of 1.005 in. and if the mean value of the drawing requirement is 1.010 in., then this central line for sums will be at $1.010 = 1.005 = 0.005 \times 3$ or 0.015. So the lower limit for sums is set at 0.015 minus (0.5×0.0087) = about 0.0107. The upper limit for sums is 0.0193.

The precalculated upper limit for the range section of the chart is figured in the following manner: First, the maximum average range must be calculated. This is equal to 0.282 times the tolerance of 0.005, or 0.0014. The control limit that stands for the maximum individual range permitted from a sample is this average range times 2.57 or 0.0036. The lower limit for range is zero for sample size of three. The numbers underlined above are constant for any other example provided the sample size is three.

Fig. 4 represents a sum and range chart for another case. Here the upper and lower control limit for sums were set at 4 and 14 units. Each unit is 0.000050 in. on an air gage. The upper control limit for ranges is at 4.3 units. These are not precalculated limits; instead they come from computations using the actual average range and average

sum from the first ten samples following the original setup.

It will be noted that zero on the air gage used stood for 6.49925 in. The three pieces for sample No. 1 each measured three units on this gage, so after the first piece a number 3 was written on the top or sum section of the chart for sample No. 1 against the left-hand scale value of 3. The second three was marked by another 3 at the intersection of the vertical sample number line with the horizontal size line that is three units higher, or at the level of 6 on the left-hand scale. The third reading gave an accumulated value of 9, and this last reading of 3 units is circled. An inspection of the three numbers marked one above another indicates that there is no difference among them. So a dot is placed at the level zero on the range section of the chart for this first sample. In the second sample the readings of 3, 2, and 4 gave a same total of 9 but gave a range value of 2, the difference between 2 and 4, the extreme readings of the sample. When the process is running "in control", it is the circled values of the sum chart that will stay within the control limits and the dots in the range section that will remain below the upper control limit. No adjustment to the machine should be attempted by the operator as long as such results are being found.

Much as in watching the pattern of tracer bullets to correct the aim of a rifle, so does the operator find that he can aim his machine to give results that fall within this allowable band. The psychological advantage of seeing what is happening is more than theoretical.

Determining Process Capability

The capability or inherent total variability of an operation for producing a certain characteristic, say, forming an outside diameter, heat-treating material, or plating to certain thickness values, will be called the natural tolerance of that characteristic. Due to a chance combination of all of the variables characteristic of any process, a certain spread of results will be obtained. The amount of this spread, which will theoretically include 99.7 percent of all the values to be expected, is this natural tolerance expressed as so many thousandths of an inch, points of hardness, etc. It is not reducible except by a basic change of the characteristics of the process. A statistical technique is available for effectively guiding the attack to reduce the inherent variability of an operation. It is called a Multi-Vari chart.[4] The total variation consists of that contained within each piece, that from piece to piece, and that from time to time. The Multi-Vari chart separates these and shows their individual magnitudes in relation to the tolerance that the operator is trying to hold. Generally it becomes immediately apparent what characteristic of the process needs to be experimentally altered in the hope of achieving a worth-while reduction in total variation.

After a minimum of ten sample results has been accumulated on the sum and range chart, the natural tolerance of that process is ready to be computed. First, get the average range by adding the range values from the chart and dividing the total

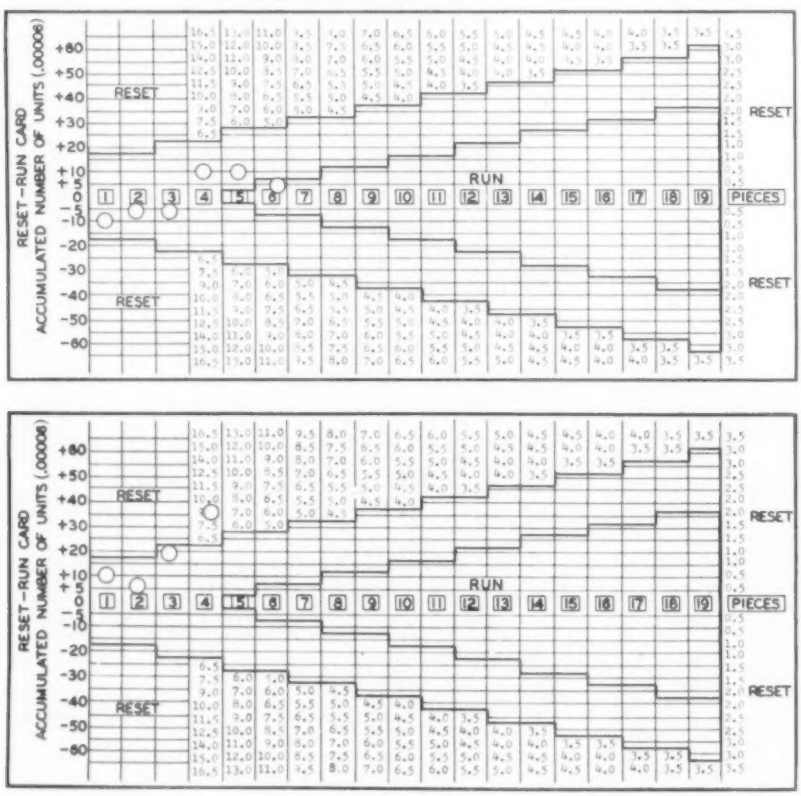


Fig. 3. Two Reset-Run card examples, the modern replacement for risky first-piece inspection.

by the number of samples (not pieces, remember—three pieces to each sample). Suppose the ten ranges added up to 0.012, which will give an average range of 0.0012. This value times 3.54 gives the natural tolerance of 0.00425 in.

Summarizing to this point:

1. The machine was placed in running order by making the obvious and necessary adjustments.
2. The first piece was run and measured. If the punch mark for this first piece on the Reset-Run card fell within the *Reset* region the machine might be reset immediately. It is to be noted that no usable estimate as to how much to reset is available until at least a minimum of four successive readings from one setting of the machine have been taken. If this first reading was not too far away, continue for at least three more pieces. On the other hand a reading quite out of line would justify resetting the machine at once by the amount that piece is away from the desired value as the next best but very rough estimate. Whenever the machine is reset, always start over again on a new Reset-Run card and on the count of 30 successive pieces.
3. If, after four or more successive readings with one setting of the machine, the *Reset* region of the card had been punched into, the number punched out was a very good estimate of how much the machine had to be reset.
4. Punch marks that ended up in the *Run* region of the card indicated that the setting was satisfactory and continued results were recorded on the sum and range chart.
5. If any of the sum or range points fell outside of the precalculated limits, the operator should take some action to bring the succeeding points back within limits. A valuable contribution of the chart is that it tells when something is happening that needs adjustment. What should be done comes from a development of the operator's experience with control charts and with that particular type of equipment. A point out of line on the sum section of the chart usually indicates trouble with the tool setting, chucking, etc., while a point out of line on the range section may mean a dull tool or some other such reason for not being able to hold sizes as well as has been possible.
6. Ten successive sample results all falling within the precalculated limits indicate that a completely valid sum and range chart can now be planned. It controls the process from there on, replacing the above steps which were designed to serve as a useful guide to eliminate major initial trouble.

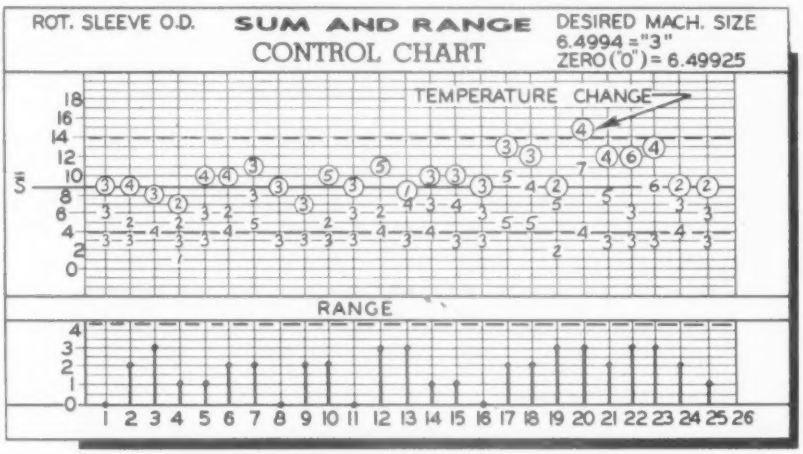

ROT. SLEEVE O.D.
SUM AND RANGE
CONTROL CHART
DESIRED MACH. SIZE
6.4994 = "3"
ZERO ("0") = 6.49925
TEMPERATURE CHANGE
RANGE
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

Fig. 4. A simplified but effective quality control chart. It needs no currently posted work sheet, shows individual measurements, and yet compares sums and ranges with control limits.

Keeping The Process in Control

The true probability control limits for a sum and range chart depend upon the average range. They will serve to keep the process within its own natural tolerance by signalling the presence of any changes. For an average range of 0.0012, the upper control limit for the range section of the chart is 2.57 times this value, or 0.0031 in. In the sum section of the chart, first take an average of the ten sums that, say, in this case, amounts to 0.013. The upper and lower control limits for sums are located a distance of 3.06 times the average range above and below this central average line of 0.013. Multiplication should give 0.0037 for this distance, so the control limits lie at 0.0093 and 0.0167 in. Again the underlined figures are constants for the sample size of three items.

Variation in results within the boundaries of these control limits is inevitable. It is characteristic of the process and, since nothing can be done about it by the operator, such results actually serve to advise him not to try to adjust his process. Realization of this fact has almost always resulted in an increase in production rate. Most machine operators,

particularly those in a job shop, feel they have to be conscientious, to recognize impending trouble as the sizes appear to go either too high or too low in their judgment. The sum and range chart replaces the actually poor judgment of the good, experienced operator with a reliable tool or indicator with which he can now make definite decisions to to when to act and when to leave everything alone. Keep in mind that this chart is particularly helpful wherever erratic behavior of the operator may at any time produce a rejectable part, quite independently of the general run of quality. It controls the operators of lathes, grinders, drills; of machines that shape, slot, mill or plane; and of hand-pressing, filing, finishing, and polishing equipment.

A good plan is to use orange crayon lines for marking the precalculated limits on the chart and red crayon lines for the true control limits known after the first 30 pieces are measured.

Each Statistical Tool Must Pay Its Way

How far to proceed along the sequence of the steps described above in these applications of scientific quality control depends upon the economic requirement of sufficient return for effort expended. Important factors are the total number of pieces to be made and any difficulty which might be expected with regard to certain characteristics. If a certain part has been made a few times in the past and absolutely no difficulty has been met in meeting all requirements without the use of statistical tools, obviously the only remaining practical incentive to try them would be that of improving the production rate. Recommended is an approach to the general problem in terms of roughly figuring the amount of potential saving, from a listing in terms of costs of scrap and rework, from those characteristics of specific items of production that are giving trouble. Trouble spots can be expected to succumb quite readily to the use of such statistical techniques as described. So it is entirely logical to limit the application of charts and the like to just those characteristics of the items that represent the major portion of recoverable costs.

Other advantages come from these techniques although they may not be quite as profitable. For example, a process capability table is of great use in a job shop. Simply list, for each machine in the shop that has been charted, its natural tolerance in terms of thousandths of an inch for various sizes of work and kinds of material. The assignment of new jobs to machines is thus considerably more reliable than depending upon general reports from the shop or upon impressions of the tooling staff which may be based on less scientifically analyzed data. Moreover, the table gives a better basis for judgment as to whether or not to take on new jobs with close tolerances.

The application of a control chart is not influenced by the rate of production per day—it is the total production of a part regardless of time that counts. It should also be remembered that a Reset-Run card checks that the machine settings are at the same place for repeat runs which occur later, perhaps many times. The following control chart can confirm the absence of new assignable causes of extra variation. For automatic operations many users of the Reset-Run card dispense with the control chart. They start a job with such a card and periodically punch out or make up a new card to assure that the setting is holding. They reason that the variability of their machine remains quite constant, being kept that way by the absence of the disturbing human element so characteristic of manually controlled operations.

Two New Corrosion-Resistant Metal Introduced

TWO ACID-RESISTING metals, results of several years' experimentation and development at Knapp Mills, Inc., were introduced at the Chemical Industries Exposition which closed this past December.

The discoveries, known as Ferrolum and Cupralum, are thought of as possible solutions to the problem of reducing the great waste caused annually by sulphuric acid which is considered the largest single destroyer of equipment. The new metals suggest a drastic reduction to the corrosion problems throughout the manufacture, transportation, storage and processing of the acid. In addition to their potential uses in this field, demand is anticipated in the expanding nuclear industries to prevent the escape of harmful rays, according to the company.

Ferrolum is made by inseparably bonding lead and steel in such a way that the finished product combines lead's immunity to the acid with steel's strength. Cupralum is made by similarly bonding lead and copper to retain the acid-resisting qualities of lead plus the high electric conductivity and heat transfer value of copper.

Economically speaking, it is possible at the present time to produce Ferrolum, lead-clad steel, and Cupralum, lead-clad copper, for less than 50 percent of the pre-war cost of producing equipment combining lead with either steel or copper.

Job Lot Materials Handling Procedures

By R. T. Willson
THE YALE AND TOWNE MANUFACTURING COMPANY

THE TERM JOB LOTS, in common with hundreds of others used in industry today means many things to many people. The best definition available is that job lot manufacture is that manufacturing activity which lies somewhere between mass production and custom-made techniques. It is in this very area that the largest percentage of all plants lie.

For plants in this category there is no "open sesame" to perfect materials handling. While conveyorized production and assembly are generally

Fig. 1. Even 3000-lb castings like these can be handled and stored economically by the unit load method. Note the pallets and pipe stringers.

associated with mass production of consumer items (automobiles, soap flakes, et al), a quick trip through plants of this type will quickly indicate that unit load handling is an indispensable part of practically every handling system. Even in one large Eastern plant devoted to making millions of beer cans of uniform size and specifications daily, fork trucks by the score run about carrying unit loads of sheet tinplate, caps, cartoned cans etc. to the production lines and shipping areas.

Conversely, even job plants addicted to the unit load system, such as fork truck manufacturers, invariably somewhere in their operation have a place for conveyors, and overhead hoists and cranes.

However, generally speaking, plants engaged in job lot manufacture will find the only practicable answer to materials handling problems in the unit load system employing skids, pallets, etc. and hand or powered platform, pallet or fork trucks or hoists and an overhead crane.

Receiving is a perennial problem for improved materials handling in all parts of industry. Even in Detroit's sprawling automobile plants where mechanize and move are practically synonymous, huge trailers back up to receiving docks to disgorge loads of castings, forgings, etc. either on the floor in bulk or by means of a gang of men handling burlap sacks of metal out of the truck to the floor. Results?

Think of your own receiving department. Do incoming parts and raw materials lie about clogging movement? How about damage? Any traceable to handling? Are your truck bodies taking a shellacking? How many men do you have working there?

The obvious answer is to ask, nay insist, that your supplier and sub-contractor ship incoming parts and materials by pallet or skid. See Fig 1. Sure, he'll be glad to do it but wait 'til you see the fee. When you query this extravagant cost he'll tell you about the cost of pallets and how he doesn't get them back, or how much it costs to get them back, or how they get broken. Since all this sounds pretty logical, let it go and you can decide to check the cost of unloading unit loads with a truck against the cost of the crew of men on your platform. After you figure up the cost of the equipment, amortization possibilities, insurance, maintenance etc., and check it against the labor cost of the crew, it's often apparent that you won't save a nickel. So that's that.

However, this is not half the story. The hidden costs may be even larger than direct labor in an operation like this. A few examples follow:

1. In addition to direct labor savings in hourly wages, consider savings from holidays and paid

vacations, social security and insurance benefits.

2. Reduced cost of supervision. (Two men don't need a supervisor—12 do.)

3. Lowered accident rate. (Safety groups say 70 percent of industrial accidents come from handling —reduced handling means fewer accidents.)

4. Less damage to incoming parts. (Some may be vitally needed today.)

5. Reduced clerical costs associated with the labor and collecting claims from carriers and writing to vendors about damaged goods.

6. Less damage to carriers.

7. Faster turnaround time for carriers—lowered demurrage charges.

8. Space savings (pallet or skid loads can be tiered right to the ceiling. How much per foot is storage space worth to you?)

9. Heat, light, and other charges associated with space increases are eliminated.

10. Tonnage handled per hour will be greatly increased. (Any cash value here? Fewer holdups and general speeding of plant operation.)

Without too much difficulty, dozens of other items not generally regarded when mechanization for handling is at stake but whose value is at once apparent could be named. Now check your savings against the vendor's charges for palletized loads. Do they look better?

All these same points may be used to impress your customers with the value of receiving his orders via pallet (i. e. unit loads) which in turn will double your savings since all operations on the shipping docks will duplicate those in your receiving areas.

Before proceeding from receiving areas, consider plant layout and its relation to good handling. Before this can even be attempted, it is helpful to have as many of the facts regarding products and processes as possible. Information will be needed

Fig. 2. Coupled parts such as these crankshafts make good unit loads, eliminating the need for skid bins or tubs.

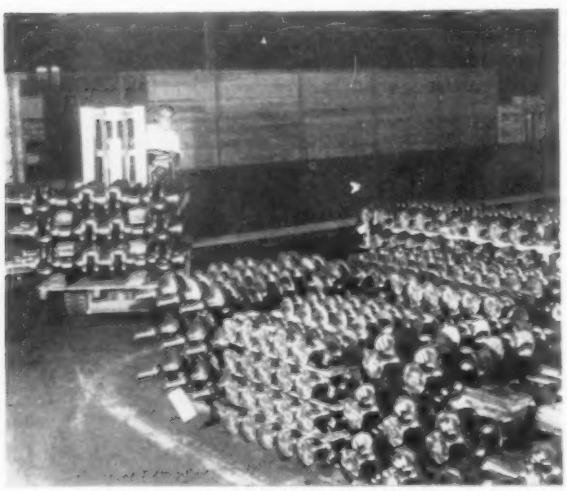


Fig. 3. Storage of small parts as shown here is both practical and economical.

such as lists of parts, their dimensions, weight and unit quantities manufactured. As nearly as possible, seasonal or yearly volume, sequence of operations performed on each part and the standard rate per piece per operation will have to be known.

Armed with this information, take a look at the layout. Are departments properly located to minimize travel from one operation to the next? Is there a lot of cross traffic?

Even design engineers can help keep handling to a minimum if they're apprised of the layout and attendant problems. It may be cheaper to buy castings with holes cast for machined inserts rather than having the casting make several special trips around the plant for simple machining, particularly if the casting is big, hard to handle or delicate.

Methods specialists can help to group processes and tools so that interdepartmental moving can be minimized along with attendant paperwork and moving cost. It is important to remember that every move can damage the product too. Even if it is packed—the packing weakens at every trip and if it is too "good" costs go out of line.

Plant Layout Aids to Materials Handling

Generally speaking it's a good rule to have all operations on the same floor. Engineers are agreed almost to a man that lifting equipment for transferring materials to another level for processing restricts flow.

Be careful about aisles. They should be wide but not too wide. One-way traffic is one method to cut down size while keeping traffic moving. Wherever possible, don't put aisles next to a wall but between departments where the equipment using the aisles can serve both sides.

Make sure that machine tools are laid out for easy access by operators to materials to be pro-

cessed. Keep operators off aisles used by mobile equipment.

There should be enough area associated with each operation or department to assure storage of sufficient and properly located raw materials. Since such reserves consume floor space and fatten inventories of work-in-progress, they should be kept to a reasonable amount. Any plant with huge reserves between operations is perhaps afflicted with production planning trouble, or poor following of same.

One of the most helpful devices used to minimize the distance that work must flow from one department to another is a travel chart. The ideal flow, of course, is to have those departments adjacent between which the most traffic moves.

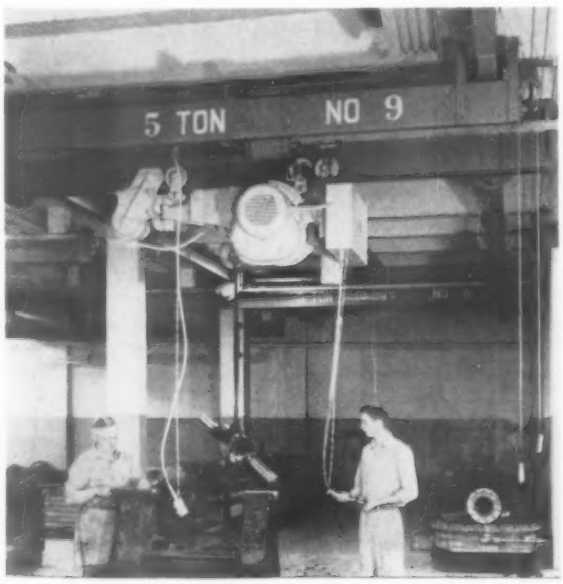
Another general point to remember is that ideally the most advantageous flow plans are the straight line and horseshoe. The straight line system has the receiving department at one end, then the processing and assembly areas and then the shipping department at the other end.

A horseshoe flow plan has adjacent shipping and receiving areas that share the same loading docks and other facilities while raw materials are processed down one side of the plant and turns for processing at the curve moving down the opposite "leg" of the horseshoe. Naturally, floor plans help determine the practicability of either of these systems.

Equipment Selection and Application

When plant layout and flow has been solved as far as economically and practicably possible, equipment should be selected. Not before. Attention must be given to containers to hold parts or materials,

Fig. 4. Overhead equipment of the correct type provides faster, better handling and positioning. It saves operator's time and cuts damage to parts.



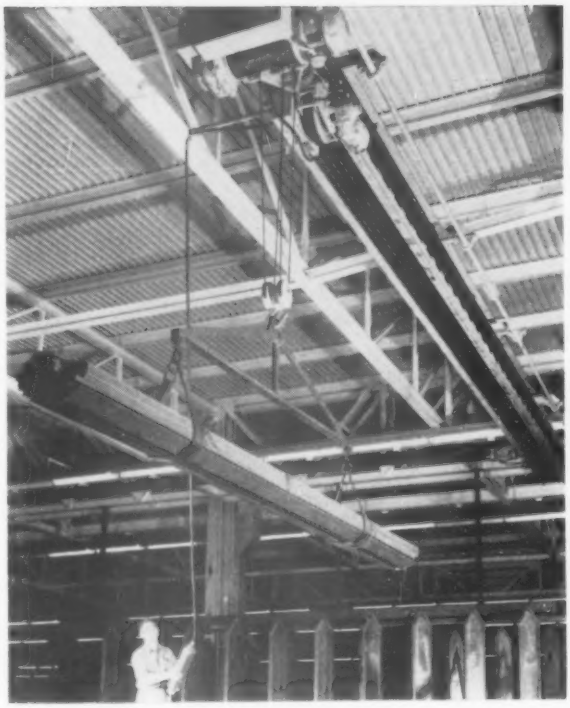


Fig. 5. Material weighing a ton can be moved with little effort. Bridge cranes operating in parallel bays can have flexibility if cross-over trackage and bridges are installed for the hoist and trolley.

some type of platform to hold these containers and motive power to move both containers and platforms.

One inviolable principle is involved here. When analysis indicates a close choice between different means of moving material, always choose the most versatile. The reasons for this are apparent but the application of the principle is often neglected.

Another maxim that is nearly always applicable, is to mechanize all handling wherever possible. However, too often this is carried to absurd lengths in favor of a particular type of equipment for which a company has a penchant, resulting in costly mistakes. The decision for a particular type or method of mechanical handling equipment should be made after all possible movements have been eliminated from the flow pattern through the plant and after layout considerations have been made. Then, consider the mechanical method and brand in light of operating economy and versatility.

It is very important at this stage to answer some very pertinent questions such as the following about your particular problems.

1. *What is the volume of material to be stored? Where, and for how long?*

Up to a certain point, materials can be stored on a conveyor, but if the volume is large and the storage period prolonged, fork trucks and pallets (or skid bins and platform trucks) are probably the

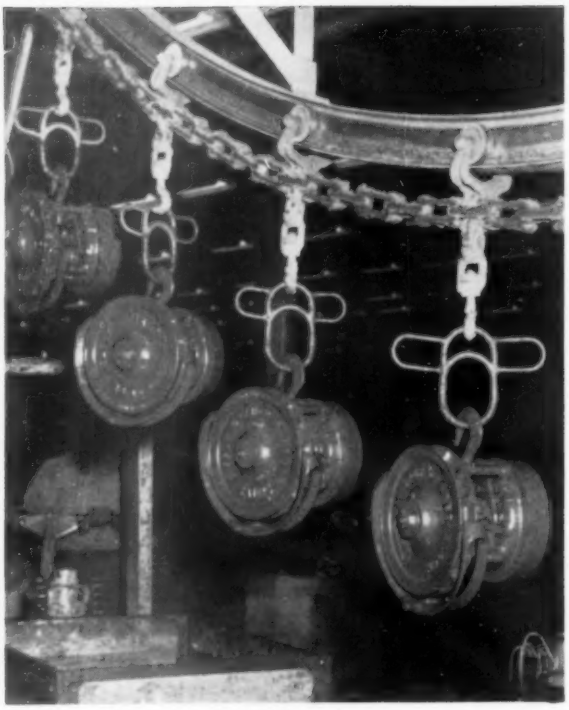


Fig. 6. Conveyors that stay up until they hit the work station save floor space.

answer. With an industrial truck of these types, tiering to as high as 25 feet is possible. If the material to be stored does not lend itself to stacking, containers should be used. The space savings with this method are important and valuable. See Fig. 3.

2. *What are manual handling costs in loading and unloading?*

More labor may be required to load and unload a conveyor at its ends than is saved by the conveyor itself. This is particularly true if the flow is intermittent. Trucks can often be used to load conveyors with pallet or other unit loads.

3. *What are the space requirements?*

Classically, conveyors eat up floor space although some overhead types that drop down only for loading or processing require little. However, aisles that trucks use are usually required for people to walk in anyhow.

4. *Is damage a problem?*

The more times that a part or assembly is handled, the more liable it is to be damaged.

5. *How serious is a breakdown in mechanical handling equipment?*

When conveyors break down, many hours of production may be lost before operation can be resumed; but if one truck fails to operate, this may not be serious if there are more than one or two. Trucks are a good standby in any event for production lines.

6. *How much initial investment is required?*

Installation of a conveyor system may cost more than the conveyor itself, and pallets may cost more than the industrial trucks initially. Check this one carefully.

7. *Does the flow pattern vary?*

Obviously, in a job shop products and processes vary widely, making conveyorized processing a handicap. But the same route and products or infrequent routing suggest some type of conveyor, generally speaking.

Future Requirements are Important

As mentioned earlier, one of the most important things to remember in the selection of systems to move materials, and in layout of the plant itself as well as in selection of equipment, is to keep an eye on flexibility. Will there be a product change tomorrow? Can quick changes in product size and material be anticipated? For job shops the answer is obviously yes to both these questions.

In any event, the corollary to this axiom is that industrial trucks can move almost anything almost anywhere. Other handling systems may or may not be movable and can require huge labor expenditures when modified.

Errors of omission are apparent in this discussion. If the subject were limited to one sentence, however, the four points stressed herein would be included. Analyze, evaluate, systematize and mechanize. In rebuttal to the shop sophisticates who may look askance on this summation as general and obvious, the facts need only to be repeated. It has been estimated by reliable authority many times that as high as 30 percent of the total production costs of any given item lies in handling. To reduce these unreasonable charges, give materials handling the attention it justly deserves, and the results will be agreeably surprising.

Fig. 7. Some plants load engine blocks on the floor. Making unit loads of them and storing them outside saves space.

Economic Principles of Cost Reduction Through Tooling

By Clement F. Brown
MECHANICAL ENGINEER

SOUND METHODS of mass production and, to some extent, jobbing work in sufficient quantities must produce finished products of uniform quality and dimensions. Tools, jigs and fixtures are important aids, and are sometimes indispensable, in accomplishing these results, and their practical use offers many advantages to both large and small manufacturers. Mechanically, various types of tools achieve one or more of several purposes. Among these are included such functions as positioning and holding parts for machining, guiding tools (such as drills, reamers, etc.) during machining operations, performing fabricating operations (such as cutting, punching, bending, and forming) on sheet metal and heavy plate work, layout and gaging to specified dimensions, and locating and holding members of a unit during assembly operations.

Economically, the prime purpose of any tooling designed and placed in production use in any field of work is to reduce costs. However, there are several ways in which a tool may fulfill this aim. These methods of cost reduction, as related to tooling for machine and fabrication work, may be enumerated and briefly explained as follows:

Direct Reduction of Unit Production Time

Reduction of unit production time is generally the first requirement given consideration for practically all types of production tooling. Any tool or fixture that, for example, enables a worker to machine or assemble a unit in less time than he could without the tool will, if sufficient parts are produced, eventually pay for itself and then begin to effect additional savings. The quantity of parts is naturally an important factor, as will be shown later. Simplified tools of limited capabilities, usually made at reasonably low costs, may reduce production time to such an extent as to warrant their use on low production runs. As a rule, this is not true in the case of large and complicated jigs and fixtures; high production quantities are usually required to offset their original cost. In some instances a tool may cut operation time in half; yet, because a low run may be spread over a long period of time, the cost of tooling cannot be justified. On the other hand, a small five-percent reduction in the unit production time on a large run may quickly dictate the necessary tooling expenditure.

Transfer of Skill to Lower Class of Labor

Cost reductions falling in this category do not necessarily depend on lower unit production times. Times may be the same or may be even slightly increased. For example, if a tool transfers the skill and job know-how on an operation from the need of a first class mechanic to the use of a semi-skilled or second class man receiving a lower rate of wages, actual operation times may be even increased by a percentage equal to the difference between the wage rates divided by the lower rate. To illustrate, suppose the wage rates of the first and second class men were $1.90 and $1.60 respectively; the operation time could then be increased by the following percentage:

$$\frac{(\$1.90 - \$1.60)}{\$1.60} = \frac{\$0.30}{\$1.60} = 0.187 = 18.7 \text{ percent}$$

increase. Of course, if the point of the total allowable percentage increase is reached, then the sole advantage of this skill transfer lies in the fact that a more highly skilled man's talents are released for more critical classes of work. In these days of skilled labor shortages, tooling may well serve this end alone on many jobs.

Elimination of One (Or More) Men From an Operation

This point may well be illustrated using welded fabrication work as an example. In many shops, large set-up jobs of this nature are handled by groups of two or three men. Generally a set-up man and a tack welder work together. On particularly large or cumbersome assemblies, a third man working as a helper is sometimes necessary. However, provision of a holding and locating fixture of such a nature as to eliminate the need of the helper will shortly reduce costs substantially. Still greater cost

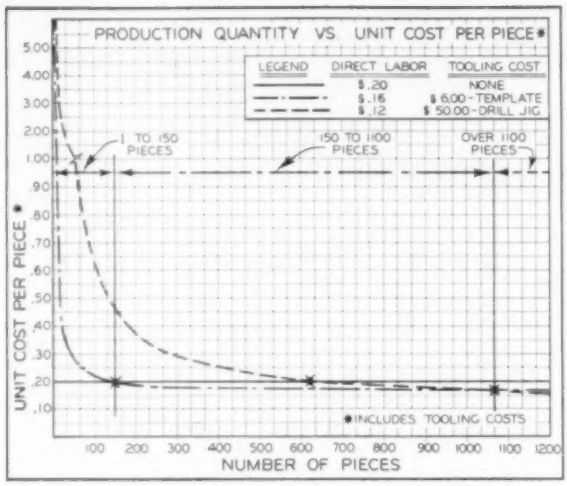


Fig. 1. Graphical demonstration of the points of economic application of tools.

reductions are possible when an assembly fixture can be turned over to a welder for setting-up and tacking the components of a unit that can be readily handled by one man, eliminating the set-up man from the operation.

Increased Product Quality and Uniformity

With no direct reduction of costs on the immediate operation with which it is concerned, well designed tooling may offset its expense by providing important and desirable advantages of commercial interchangeability, eliminating the need of selective assembly and resulting in lower assembly and erection costs. Increased part accuracy also materially eases the problem of supplying replacement parts when required.

There are no doubt other advantages which could be added to those already mentioned. Good tooling serves to minimize inspection and supervision required on a job, thereby reducing overhead or indirect labor costs. Tools that are of an error-proof nature, such as a drill jig containing a protruding dowel pin to prevent improper loading of parts, will often save their price in improperly worked parts in a short period of time.

Individually, any one of these several factors mentioned may determine the need and extent of tooling for a production program. However, any tool may well achieve several or all of these closely related purposes.

Properly acquainted with the various ways in which tooling can reduce costs, the next question is one of when and how much to tool up for any individual job. This question can be answered by analyzing the job, making a careful estimate to determine unit production costs without tooling, and then calculating the degree of tooling that can profitably be applied to a production run of any specified lot size. In many instances, the entire case must be built on estimates; occasionally, records of actual production time (based on previously produced parts) are available and will prove most helpful in drawing an accurate conclusion to the tooling problem.

To illustrate the formula and line of reasoning used to solve problems of this nature, a simple case can be investigated. It will be assumed that unit production costs are in terms of direct labor. The problem is centered around a simple layout and drilling operation that can be done for a labor cost of 20¢ per unit with no tooling involved. A sheet steel template used to eliminate measuring connected with the layout operation will reduce the unit cost to 16¢; a drill jig, removing all layout work by directly positioning the parts relative to drill bushings, further reduces the unit cost to 12¢. The layout template costs $6, and the jig can be provided for a price of $50. The question posed is: At what number of pieces will it be economically practical to introduce these tools into the production plan? The following formula will supply the answer:

$$\frac{\text{Tooling Cost}}{\text{Number of Pieces}} + \text{Tooled Unit Cost} = \text{Untooled Unit Cost.}$$

Transposing the formula to solve for the number of pieces, we have the following:

$$\text{Number of Pieces} = \frac{\text{Tooling Cost}}{(\text{Untooled Unit Cost} - \text{Tooled Unit Cost})}$$

To determine at what production quantity it will be feasible to make the layout template, we have:

$$\text{Number of Pieces} = \frac{600}{(20-16)} = 150 \text{ pieces}$$

The proposed drill jig will pay for itself at the following production quantity:

$$\text{Number of Pieces} = \frac{5000}{(20-12)} = 625 \text{ pieces}$$

However, these two calculations do not represent a true and complete picture of the problem. Another factor must be given consideration; there exists a definite relationship between costs of production using the two types of tooling suggested for this job. In other words, the price variation between the template and jig will indicate a new and higher number of pieces at which quantity a financial saving will be realized by the use of the jig. To determine this quantity, the tooling cost difference must be introduced into the formula as shown in the next step.

$$\text{Number of Pieces} = \frac{(5000-600)}{(16-12)} = 1100 \text{ pieces}$$

The results of these calculations are shown

(Continued on page 50)

Right and Wrong of Hob Sharpening

By A. Zamis
CHIEF ENGINEER
ILLINOIS TOOL WORKS

PRECISION GEARS play a vital role in today's economy. Through their application, automobile transmissions are more compact and efficient, ships sail faster and diesel locomotives haul more freight.

For this reason, a great deal of engineering attention has been devoted to the various factors involved in precision gear production. The need for accurate machines and cutting tools, together with careful set-up procedures, is well understood.

Not enough notice, however, has been given to hob sharpening, a necessary operation wherever gears are produced by hobbing and fully as important as original hob accuracy in its effect on gears produced. Even the finest class A precision-ground hob will produce poor gears if improperly sharpened.

Fundamentally, hobbing is a generating process in which gear teeth are formed by a sequence of cuts made by successive hob teeth in a continuously rotating gear blank. In order for the tooth form to be accurate it is essential that the hob teeth have the correct form or pressure angle, and that the hob teeth lie along a helix of the correct lead.

Hob manufacturers hold these important elements to very close tolerances and further, to facilitate sharpening, relieve the hob teeth in such a manner that it is possible to sharpen the hob repeatedly to the very end of its useful life without affecting the accuracy of the gears produced. But the sharpening must be done properly because both pressure angle and lead can be adversely affected.

Hobs are sharpened by grinding all flutes until no trace of a worn surface is visible on the tops or sides of the hob teeth. Grinding should extend deep enough to blend in with the bottom of the flute. Three flute elements may be affected by sharpening. These are spacing; rake (a radial flute has zero rake); lead (a straight flute is parallel to axis and has an infinite lead).

All of these elements must be held within the tolerances listed in Table I if the original accuracy of the hob tooth form and lead is to be maintained. These tolerances, standardized by the Metal Cutting Tool Institute, are maintained by all hob manufacturers. When a hob is sharpened within these tolerances, the gear tooth accuracy will not be impaired.

Flute Spacing Error

Fig. 1 shows the effect of sharpening with unequal angular spacing of the cutting faces. Every lead variation caused by such faulty sharpening shows up in a one-to-one ratio as an error in the gear tooth profile. Roughly, the lead variation is

Table I—Sharpening Tolerances for Single Thread Hobs.

Spacing Between Adjacent Flutes	A Precision Ground	40	30	25	20	15	10	10	10	10	10
	B Commercial Ground	50	45	40	30	20	15	15	10	10	..
	C Certified Unground			40	30	20	15	15	10	10	10
	D Commercial Unground	60	60	50	50	30	25	25	20	..	..
Spacing Between Non-Adjacent Flutes	A Precision Ground	80	60	50	40	30	30	30	25	25	20
	B Commercial Ground	100	90	80	60	50	50	50	40	35	30
	C Certified Unground			80	60	50	50	50	40	35	30
	D Commercial Unground	120	120	100	100	80	80	70	60	..	..
Cutting Faces Radial To Cutting Depth	A Precision Ground	30	15	10	8	6	5	5	3	3	3
	B Commercial Ground	50	25	15	10	8	7	7	5	5	5
	C Certified Unground			15	10	8	7	7	5	5	5
	D Commercial Unground	100	75	50	40	30	20	20	15	..	..

		Face Width	0 to 1-in.	1 to 2-in	2 to 4-in.	4 to 7-in.	7-in and up
Accuracy of Flutes, Straight And Helical	A Precision Ground		10	15	25	30	50
	B Commercial Ground		10	15	25	30	50
	C Certified Unground		10	15	25	30	50
	D Commercial Unground		15	23	38	45	75

The figures in the table represent total indicator reading in ten-thousandths of an inch.

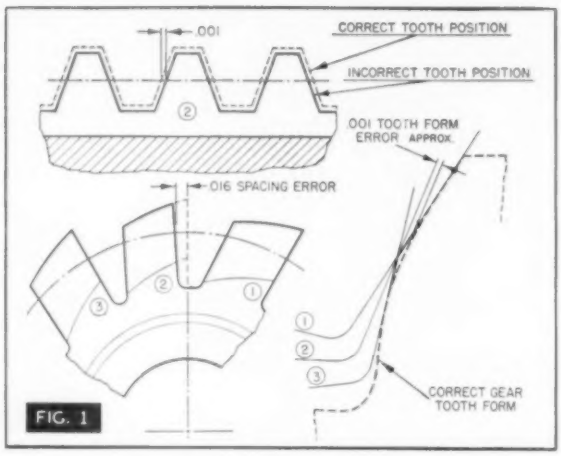


FIG. 1

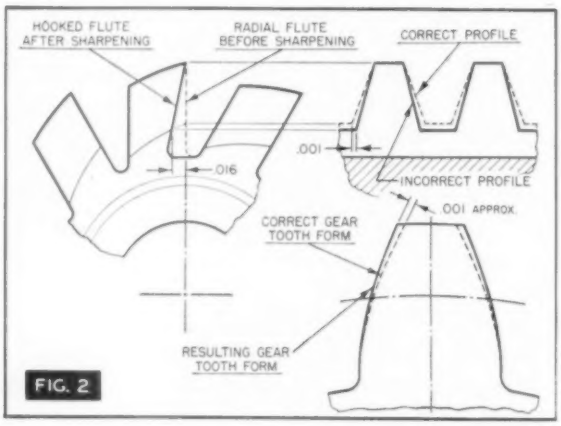


FIG. 2

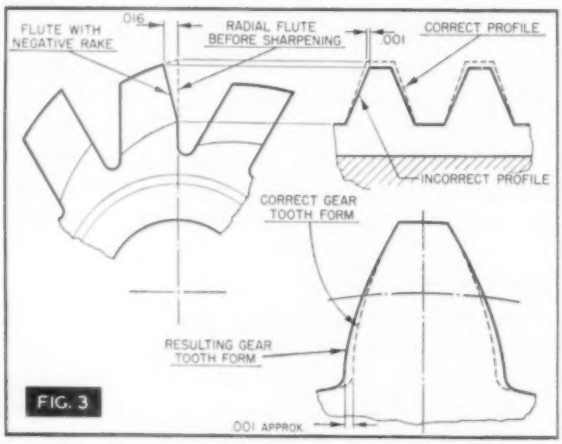


FIG. 3

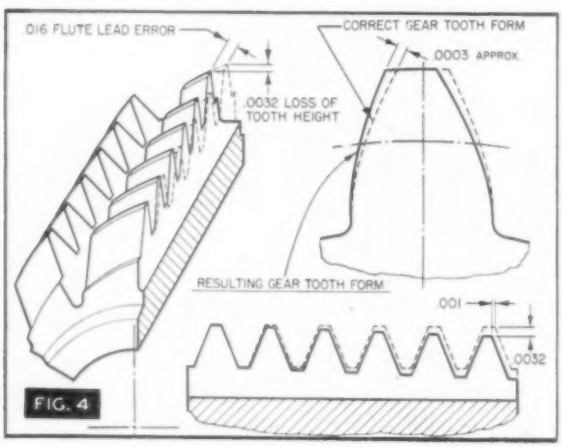


FIG. 4

about $\frac{1}{16}$th of the flute spacing error. A spacing error of 0.016 in. would produce about 0.001 in. error in the lead and in the gear tooth profile.

The most common reasons for excessive flute spacing errors in sharpened hobs are:

1. Excessive runout of the hob during the sharpening process. This may be caused by loose-fitting or eccentric arbors, non-parallel collars, excessive tightening of the nut, or runout of the machine work spindle.
2. Use of worn index plates or pawls in the sharpening machine.
3. Not "sparking out" the grinding wheel.

Under no circumstances should the tool sharpener remove more material from any one flute just because it shows greater wear. This would create a large flute spacing error and inaccurate gear tooth profile. All cutting faces must be ground back the same amount that is needed to sharpen those showing the greatest amount of wear.

Flute Rake Error

The effect of sharpening the flute with a hook when it should be radial is shown in Fig. 2. Because of the side clearance, this sharpening error makes the base of the hob tooth narrower and, as a result, the gear tooth becomes thicker at the tip. Here again an error of 0.016 in. from radial will cause approximately 0.001 in. of error in the gear tooth profile.

Occasionally hobs are designed with a hooked flute. In such cases the hob tooth form or pressure angle is changed to correspond to the hooked flute. Such hobs must be sharpened with a hook. On hooked hobs the hook angle and rake are marked on the end of the hob.

The cause of an error in the rake of the flute is improper set-ups of the grinding wheel in relation to the hob axis. Fig. 3 shows the effect of sharpening the flute with a negative rake. Because of the side clearance, this sharpening error makes the tip of the hob tooth thin and, as a result, the gear tooth is thicker at the root. Again an error of 0.016 in. from radial will cause about 0.001 in. error in the gear tooth profile.

This sharpening error is also caused by incorrect setting of the grinding wheel in relation to the hob axis.

The effect of sharpening helical flutes with incorrect lead or straight flutes non-parallel with the hob axis can be seen in Fig. 4. The result

Fig. 1. The effect of sharpening with unequal angular spacing of the cutting faces is shown here.

Fig. 2. Here the flute has been sharpened with a hook when it should have been radial.

Fig. 3. Sharpening the flute with a negative rake produces the effect shown here.

Fig. 4. Illustrated here is the effect of sharpening helical flutes with incorrect lead or straight flutes non-parallel with the hob axis.

is an error in the lead and form of the hob teeth. In fact, the lead on one side of the teeth becomes longer than the theoretical lead and the lead on the other side shorter. This produces a "leaning" gear tooth; one side plus, the other minus.

However, a flute lead or parallelism error would have to be much larger than flute spacing or rake error in order to affect the gear tooth profile to the same degree. This is true because only about two convolutions of hob teeth finish the gear tooth profile. A 0.016 in. flute lead error would result in about 0.001 in. lead error over all convolutions of hob teeth. Assuming the hob had eight convolutions, the gear tooth would be affected by one-fourth of the total lead error of 0.001 in. The resulting tooth profile error would then be about 0.00025 in.

It is interesting to note that a flute lead error, because of the cam relief on the hob tooth, creates a tapered hob. The flute lead error is approximately 10 times the amount of taper in the hob diameter. Since the taper can be measured easily, this affords a quick easy way of measuring the flute lead error.

A sharpening error in flute lead may be caused by an incorrect sine bar setting, excessive backlash, worn machine parts, misaligned centers or failing to "spark out."

How Hobs are Sharpened

Machines designed and built solely for hob sharpening are on the market. These machines have automatic indexing provisions and can sharpen hobs with helical as well as straight flutes. Hobs can also be sharpened in a cutter-sharpening machine. However, in this case, the backs of hob teeth in straight fluted hobs must be ground to provide accurate indexing surfaces for a steel supporting finger such as is commonly used in cutter sharpening.

Hobs with helical flutes which are to be sharpened in a cutter sharpener require a guide bar. This bar must have the same number of equally spaced grooves of the same lead as the flutes of the hob. This guide bar and hob are mounted securely on an arbor and placed between centers on the cutter-sharpener table. A guide finger mounted on the machine and engaging a groove on the guide bar rotates the hob the correct amount in relation to the table travel past the grinding wheel.

A saucer-shaped grinding wheel is used for hob sharpening. For straight fluted hobs either the flat or cone side of the wheel may be used. However, the cone side is preferable because of more uniform pressures between the wheel and the hob. With a flat wheel, the area of contact between the wheel and hob is small at each end but large in the center. See Fig. 5. If a heavy cut is being taken, more stock is removed at the ends and less in the center. To correct this, more passes must be made through each flute.

The flat side of the wheel cannot be used for helical flutes because of interference at the root and top of the flute, resulting in a convex, non-radial cutting face. See Fig. 6.

The cone side of the wheel works well for all helical flute hobs excepting those with large thread angles such as are found in multiple thread worm gear hobs. In such cases, interference becomes noticeable and the wheel must be dressed to a curve that eliminates interference.

Effect of Sharpening Technique on Hob Life

In sharpening, care should be taken to avoid excessive heat. It is easily possible to create enough heat to soften the cutting edges and greatly increase the rate of hob wear. Another danger of excessive heat is the propagation of tiny cracks at the base of the hob teeth which often results in tooth breakage. The "high" flute should be "kissed" before feeding in, or runout and unequal spacing conditions, when combined with the feed, may result

Fig. 5. With a flat wheel, the area of contact between the wheel and hob is small at each end but large in the center.

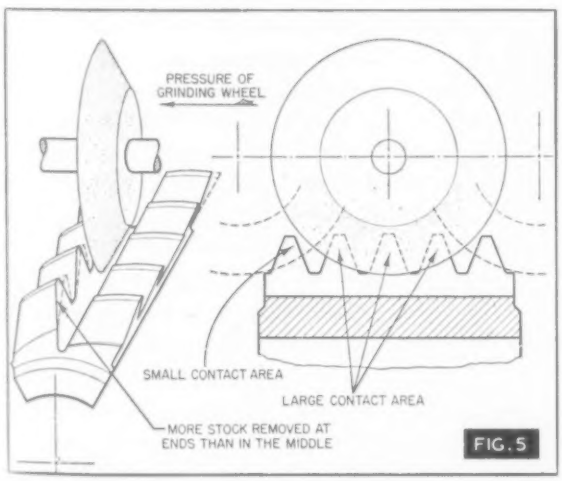
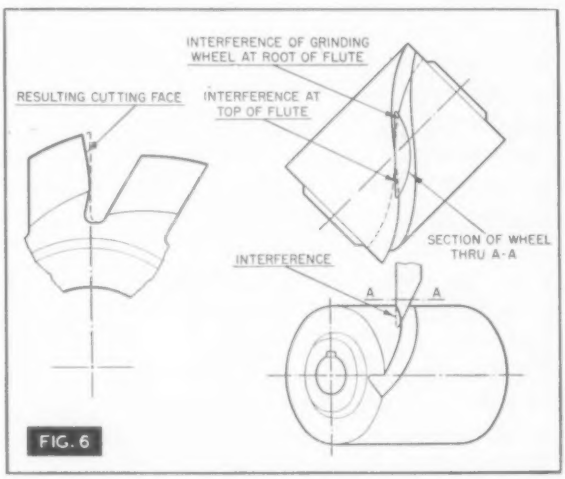


Fig. 6. Using the flat side of the wheel on helical flutes results in a convex non-radial cutting face.



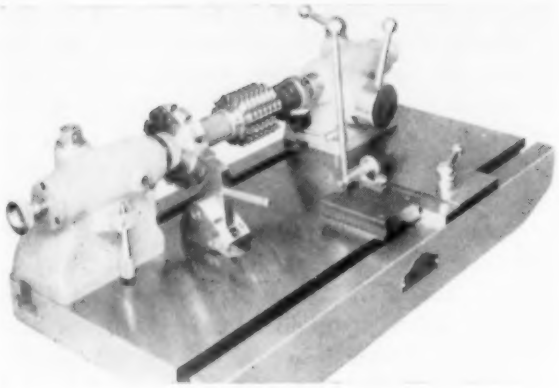


Fig. 7. The machine shown here checks the rake of sharpened straight or spiral gashed hobs and cutters. It also checks parallelism and straight gashes, but it does not check the lead of straight gashes.

in too heavy a grinding cut and excessive heat.

It has been proved over and over again that more gears can be cut per sharpening when the grinding finish on the cutting faces of the hob teeth is good. It definitely pays to sharpen hobs with a good finish. The wheel should be dressed before the finish cut and the wheel should be allowed to "spark out", not only for accuracy's sake, but also for improved finish.

Need for Sharpening Inspection

It is obvious from the preceding that sharpening errors can result in gear tooth inaccuracies which prevent satisfactory gear performance. It is essential that hobs be sharpened accurately.

Sharpening errors, however, will occur. Mistakes will be made in the set-up, machines will wear or become misaligned, worn arbors will be used, nuts will be tightened excessively, grinding wheels will not be allowed to "spark out", dirt and chips will get between collars, etc. And sharpening errors, even though large enough to cause intolerable gear errors, usually cannot be seen or measured with the naked eye.

Since it is only common sense that hobs with excessive sharpening errors be prevented from reaching the hobbing machine and cutting gears that will have to be scrapped, the need for hob sharpening inspection is evident. A special machine designed for this purpose is shown in Fig. 7. It measures directly, by means of a dial indicator, errors in flute spacing, rake and parallelism of straight flutes. Flute lead errors are obtained indirectly through measurement of the taper in the hob diameter which results from an error in flute lead. The flute lead error is approximately 10 times the taper on diameter or approximately 5 times the difference in indicator readings taken over the high points of the end teeth in the flute. These indicator readings can be obtained in the hob sharpening inspection machine.

The above has been directed mainly to gear hobs but it applies with equal force to all hobs including sprocket hobs, spline hobs and worm gear hobs. In worm gear hobs the higher pressure angles and greater side clearance angles often used aggravate the bad effects of sharpening errors on the worm gear tooth form. Large helix angles are common in these hobs and special wheel dressing is needed to avoid interference when sharpening.

Cost Reduction

(Continued from page 46)

Through Tooling

graphically in Fig. 1. Points of economical application of both types of tools considered are clearly indicated, as well as the unit cost per piece for any given quantity. Whereas untooled production shows a constant cost of 20¢ per piece, the lines representing the two degrees of tooled production will never quite reach the 16¢ and 12¢ unit costs originally estimated. Regardless of quantities, some small fraction of the tooling cost must always be applied to each part drilled. However, it is plainly evident that high production runs will reduce this fraction to an almost negligible amount in terms of unit tooling cost.

This simple problem analyzed herein could be considered in other respects. For instance, it might be desired to know how much cost could be allowed for the drill jig for a given lot size when the savings per piece are known or have been estimated. The formula could then be transposed, and expressed as follows:

Tooling Cost = (Untooled Unit Cost — Tool Unit Cost) × (Number of Pieces). Here, as in the original approach to the problem, the "break even" point is indicated. If the contemplated tool can be made for less than its estimated cost, or the lot size is increased, definite savings will result. Other factors, such as the time required to absorb tooling costs and tool depreciation, can be introduced into the basic formula to provide more accurate and complete answers to the economic questions concerning tooling.

The economic advantages of tooling, often readily apparent (pro or con) without studied thought or calculation, can quickly be determined by applying this simple formula to borderline cases. It is essential that tooling of any degree comply with these economic principles to be of true practical value.

Effective Tool Control For the Small Shop

By George Whitley

WHILE MOST LARGE manufacturing plants have an identification system for controlling tools, jigs, fixtures, dies, etc., many small shops do not. In the smaller establishments, the tool is built, put into operation, and after the job is completed, stored on a shelf in the tool crib. There is no record of the tool and the memory of the crib attendant must be relied upon to produce it when it is needed again.

In some instances, the tool is given the same number as the part on which it is used, but the same tool might be used for several jobs with different numbers. Mistakes are likely to occur unless the operator is familiar with the tool itself and the number assigned to it.

A very effective, yet quite simple, method of identifying a tool, jig or fixture is to assign a number to it which characterizes the tool itself. The tools can then be arranged in the tool crib under this number and all tools of similar types and uses kept together. This system also provides a record of the quantities and the space required for the various types of tools in the crib itself.

The following example shows how this system may be adapted for use in most any plant.

Since the two main categories are tools and dies, use a T before all tool numbers and a D before all die numbers. The numbers have five digits each.

For a permanent record, make a card index file. If the shop has routing sheets or process cards which accompany jobs, the tool number is placed next to the operation to be performed with it. The operator can then quickly obtain the necessary tool.

The first digit identifies the type of tool, thus:

T(1)0000—Cutting tools, form tools, etc.
T(2)0000—Adaptors
T(3)0000—Jigs
T(4)0000—Fixtures
T(5)0000—Templates
T(6)0000—Gages
T(7)0000—Machines
T(8)0000—Miscellaneous
T(9)0000—

The second digit tells when it is used:

T 1 (1)000—Lathe
T 2 (2)000—Mill
T 3 (3)000—Shaper
T 4 (4)000—Drill Press
T 5 (5)000—Bench
T 6 (6)000—Hand screw machine
T 7 (7)000—Automatic screw machine
T 8 (8)000—Floor
T 9 (9)000—Miscellaneous

Thus, a tool with the number T-17001 is identified as a cutting tool by the first digit; the second digit designates it as one used on an automatic screw machine; the last three digits are the tool number. When there are more than 1000 similar tools, extend the number to six digits, keeping the first two identifying digits as above.

Similarly, dies can be broken down into the following categories:

The first digit identifies the die as to type.

D (1)0000—Blanking die
D (2)0000—Forming
D (3)0000—Piercing
D (4)0000—Shaving
D (5)0000—Drawing
D (6)0000—Compound
D (7)0000—Double action
D (8)0000—Progressive
D (9)0000—Miscellaneous

The second digit identifies the press on which the die is used.

D 1(1)000—Foot press
D 2(2)000—Bench press
D 3(3)000—Single-action
D 4(4)000—Double-action
D 5(5)000—Hydraulic
D 6(6)000—Toggle
D 7(7)000—Draw
D 8(8)000—Arbor
D 9(9)000—Miscellaneous

Carbide Tools for Job Lot Production

By Russell McLaughlin

CUTTING TOOL ENGINEER
ALLEGHENY LUDLUM STEEL CORP.

THE USE of cemented tungsten carbides in the metal-forming industries is common today in those plants where production runs are so high as to be considered continuous. In fact, these high production jobs have received so much publicity that the use of carbide for metal-forming (cutting, bending, drawing, blanking etc.) is synonymous with large volume runs. But where is the place for carbide in a plant which produces a few hundred, or a few thousand pieces, instead of hundreds of thousands or millions?

To consider the use of carbide for small-lot production, let us first consider the kind of tool required and the operation it is to perform. Carbide cutting tools can be divided into three broad groups: first, the single-point tools which include standard tools, special tools and form tools; second, milling cutters; and third, the other rotary tools, e.g., reamers, spotfacers, counterbores, countersinks etc.

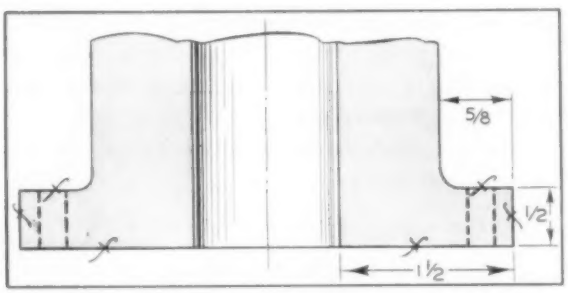


Fig. 1. Carbide tools can reduce costs on jobs such as turning and facing the valve flange shown here.

The first of the above groups is by far the largest, and standard tools form the biggest section of this group. The relatively low present-day cost of standard tools and widespread knowledge of their use and advantages make them almost a "must" for most turning, boring or facing jobs. A typical example to show their ability to reduce costs on small job lots is turning and facing the valve flange shown in Fig. 1. Data is as follows:

Work Piece: High-alloy steel valve body, having a 6¼-in. diameter flange, ½-in. thick, to be turned, faced and back-faced. Rockwell 'C' 28-32.
Quantity: 300 pieces
Machine: 14-in. engine lathe
Tools: Style BR-12 and FR-12 (carbide), Grade TC-6. HSS tool — ¾-in. sq., standard length.

Performance:	*With High-Speed Steel Tools*	*With Carbide*
Speed:	67 S.F.P.M.	263 S.F.P.M.
Rpm:	43	174
Depth of Cut:	Average—3/16 in.	Average—3/16 in.
Feed Roughing:	.028	.018
Finishing:	.012	none
Pieces per Grind:	38	90
Tool Cost:	$2.60 ea.	BR-12—$2.47 FR-12—$3.50
Machining Time—Roughing:	2 min. 22 sec.	52 sec.
Machining Time—Finishing:	3 min.	none
Total Time per Piece:	5 min. 22 sec.	52 sec.
Total Time Saved:	22½ hrs.	

This does not include the time saved in tool changing or resharpening, or the production time gained by fewer tool changes. It is to be noted that a large portion of the time saved was by the elimination of the finishing cut, due to the smooth, bright finish produced by the carbide at the high speed and finer feed. However, on the roughing cut alone, 7½ hours, almost a full operator-shift, has been saved by the use of carbide tools.

Another job was the rough turning of a large steel roll, approximately 36 in. in diameter by 5 ft long. This job had been done before at 3½ rpm and ⅛ in. feed using high speed steel and required 11.4 hours. With carbide (Grade TC-5) at 10 rpm and 0.060 in. feed, the job required only 8⅓ hours, sav-

ing more than three hours on the job. It was estimated that carbide could have been operated at a higher rpm (12-14) but the horsepower available on the machine was not sufficient to allow this further saving.

Most small shops today use standard carbide tools for turning, boring and facing operations. There are many reasons for this acceptance besides the obvious cost saving on machining time. These tools are readily available, inexpensive (remember when each carbide tool had its own felt-lined wooden box?), and no changes in setup are needed except stepping up to carbide speeds to reduce the machining time. This is often the only cost-reducing method which can be applied to simple, small-run jobs. The number of pieces does not warrant fixtures which would reduce set-up time; jigs for tool setting or locating would be prohibitively expensive; special fixtures or attachments for the machine are not available. When these conditions exist, reducing the machining time becomes of great importance in producing at lowest possible cost.

With special tools, the availability and cost of the tool must be considered. If a special tool can be ground from a standard, or if a piece of shank steel, a carbide tip in stock, and a torch can make the necessary tool, the considerations are about the same as for a standard tool. But if the tool has to be purchased, causing delay, or if its price per finished work part is greater than the dollar value of the machining time it would save compared with some other tool material, obviously it is uneconomical to use. Fig. 2 shows a chart for comparing the relative costs of carbide and high-speed steel tools.

Form tools are more expensive and generally require a job-lot of at least a few hundred or a few thousand pieces to be practical. Other factors play a more important part here also. For example, are tolerances so close as to require the superior wearing qualities of carbide? Can the work be satisfactorily machined with another material? These considerations are becoming more important as the close-tolerance, tough-to-machine materials for defense work become more common.

For plain milling operations, standard carbide-tipped face mills can be, and are, used much the same as standard tools. That is, a carbide milling cutter is set up as easily as a high-speed steel mill and the operation is similar; but the much greater speed at which carbide operates reduces the machining time on the order of 3 or 5 to one. Where special milling cutters are needed, their cost and the time necessary to procure them prohibit their use for small-run jobs. An example of savings on carbide milling is the machining of a very large weldment for the center section of a large power shovel. This part was more than fifty feet long and had several bosses and large locating areas which had to be face-milled. Although the material was mild steel, the weld seams dulled the high speed steel cutters very rapidly, and the cutting speeds were quite slow. The high-speed steel cutters, 12-in. diameter, 24 teeth, were operated at 34 rpm and 2½ ipm feed, or just over 0.003 in. feed per tooth. When changed to a 12-in. diameter, 18-tooth carbide milling cutter, the speed was raised to 100 rpm and the table travel to 9 in. per minute (0.005 in. feed per tooth). Although no direct time saving on the whole job done with carbide as compared to high speed steel is available, about 45 hours was spent completing approximately 25 per cent of the job with high speed steel. The balance of the job—three times as much—was completed in another 52 hours with carbide. It might be of some interest that the loss from an accident which occurred with the carbide cutter (the operator accidentally stopped the tool in the cut, breaking eight blades) was considered negligible compared to the overall savings effected.

The other rotary tools, the reamer, spotfacer etc., are little used for job-lot machining. Many of these tools are available as standard items, and they are used extensively on production jobs. But so far they have been used on low production runs only where the superior finish or the tolerances they hold is necessary to produce a quality part. Of course, these tools, as with all other carbide tools, are often necessary where no other type of tool will cut the work material satisfactorily. For example, a carbide rotary burr used to drill a hole in an already-hardened die can save the cost of annealing, drilling and rehardening the die section—even if these operations can be done.

Fig. 2. Cost Analysis Chart to Determine the Economic Advantages of Carbide Tool Applications

Workpiece.....	Quantity.....	
Material.....	Machine Tool.....	
Physical and chemical specification.....	Capacity (hp).....	
	Cutting Tools.....	
	HSS	TC
Speed (sfpm)	.....	.....
Rpm	.....	.....
Depth of Cut	.....	.....
Feed (ipm)		
1.—Roughing	.....	.....
2.—Finishing	.....	
Tool Cost		
Unit Cost	.....	.....
Total Tool Cost	.....	
Machining Cost		.....
1.—Roughing time/piece	.....	.....
2.—Finishing time/piece	.....	
Total Machining Time	.....	.....
Total Machining Cost	.....	.....
Grinding Cost		
Pieces per grind	.....	.....
No. of grinds	.....	.....
Cost per grind	.....	.....
Total grinding cost	.....	.....
Tool Change Cost		
1.—No. of changes, roughing	.....	.....
2.—No. of changes, finishing	.....	
Time per change	.....	.....
Total time, tool changes	.....	.....
Total cost, tool changes	.....	.....
Total Cost	.....	.....
Cost per piece	.....	.....

Using Standard Data for Tool Estimates

By Norris M. Perris and H. K. Keever

PARTNERS

STEVENSON, JORDAN & HARRISON, INC.

COMPANIES WITH a variety of products made in small lots are sometimes at a disadvantage in deciding where tools can be profitably employed. In such job shops there does not seem to be suitable cost or output data available to management and tool engineers so that they can readily agree on an economical and profitable tool program. This may result in very little planning of the process in advance of production. It also results in a noticeable omission of tool engineering opportunities. The reverse should be true.

Standard time data supplies the answer to this problem. Standard time data furnishes tables of time values for use both by tool engineers and process engineers in such a way that it is readily apparent to management when a tool is worthwhile.

These principles are equally applicable in any industry whether they are mass production, a job shop, or even a custom made shop. It is sometimes assumed that standard time data is only for the medium and small concerns, which is false. There are possible sound applications of job shop principles in the use of tools in some departments of mass production plants such as maintenance, tool and die shops. In shops of this nature industry dismisses possible tool applications on short runs "with a wave of the hand". A few minutes spent in analyzing the possible cost savings of producing such short runs through the use of a few simple tools will convince them otherwise.

Standard Data Defined

The fabrication of metal parts and products consists of these five major steps: the work of setting up the machine; loading and unloading the machine; cutting the piece to the shape and size desired; operating the machine to produce the cuts; measuring the cuts for tolerance to check the accuracy.

Thus in each machine operation there are five distinct time studies to be made. Standard data consists of the final result of timing each of these steps. However, this is not the procedure in actual practice. There is a distinct technique to setting standard time values which will not be covered here. Only its use will be explained.

Standard Data Classifications

The scope of work and time to perform the five steps listed above is too broad for practical use. Each of these steps must be time studied and analyzed for the factors that influence the total time to perform these steps. Therefore, standard data tables must be further divided in the following manner:

(1) The work of setting up consists of placing various attachments on the machine to hold the piece. They can be bolts, clamps, chucks, jigs and fixtures, and other common devices. Standard time data consists of selected times from time studies to determine the time to use these attachments. The total time for setup then becomes the summary of the times for using whatever attachments are needed to perform this operation.

(2) Similarly, loading and unloading of the machine consists of the time required to place onto and remove the part from these chucks, jigs and fixtures, or other attachments used. This may be done by hand or with the aid of hoists. The standard time data includes a series of times for placing onto and removing the part from the devices mentioned.

(3) Cutting of the metal consists of two steps: (a) determining the type of tool steel and type of tool required for the hardness of the metal and the finish required; (b) determining the best feed and speed relationship which will remove the greatest number of cubic inches of metal in the least amount of time. Standard time data also includes a speed and feed table for a number of different cutting

steels for a variety of surface finishes.

(4) The machine is now ready to operate. Power is applied. The starting and turning off of this power, generally speaking, consists of setting stops, positioning of tools, etc. Standard data gives the time for performing each of these machine movements.

(5) Certain hand movements are required to measure a piece. The time of these hand movements is covered by standard data for using a scale, calipers, micrometer, gages, etc.

It is apparent that these times are in fractions of a minute. They are small but specific time values. Their application is varied and universal. A sample of standard time data is shown in Fig. 1. Similar additional standard time tables have been developed for all other types of machine tool equipment.

How Tool or Process Engineer Uses Standard Data

The time shown on the standard data table is far superior to "rule of thumb" estimates based on general practices without detailed analysis and figures. Overall costs and general shop information ceases to have any significance when process and tool engineers get together to work out the tool program using standard data in the following manner:

(1) They know the time it takes to use any one of the common attachments required in setting up the machine. They know the difference between the time for using one attachment and using another. If the use of a simple tool or device enables them to use the attachment which takes the least amount of time, they are in position to do so. What is more important, they are able to estimate the savings resulting from the use of these simple tools in terms of reducing the costs of set-up.

(2) Similarly, they have at hand the standard times for various loading devices. Likewise, they are in a position to advocate the use of one or more of these loading devices depending on the time that would be saved.

(3) The speed and feed tables are an "open sesame" to ideas for the tool engineer. The use of a few simple tools now and then enables them to use cutting steels at their maximum effectiveness, i.e., removal of the greatest amount of metal in the least amount of time. Without these auxiliaries, the maximum speed and feed relationship could not be obtained.

(4) Examples will be given later to show how the machine can operate continuously instead of intermittently through the use of tools and other devices. This continuous operation is often overlooked in the job shop. Standard data points out the profitableness of its use.

(5) Select the most economic measuring device available. Standard time data points the way to reducing both the skill of labor and the time required through the use of auxiliaries that make otherwise expensive measuring devices economical in the long run.

Standard Time Data in Assembly

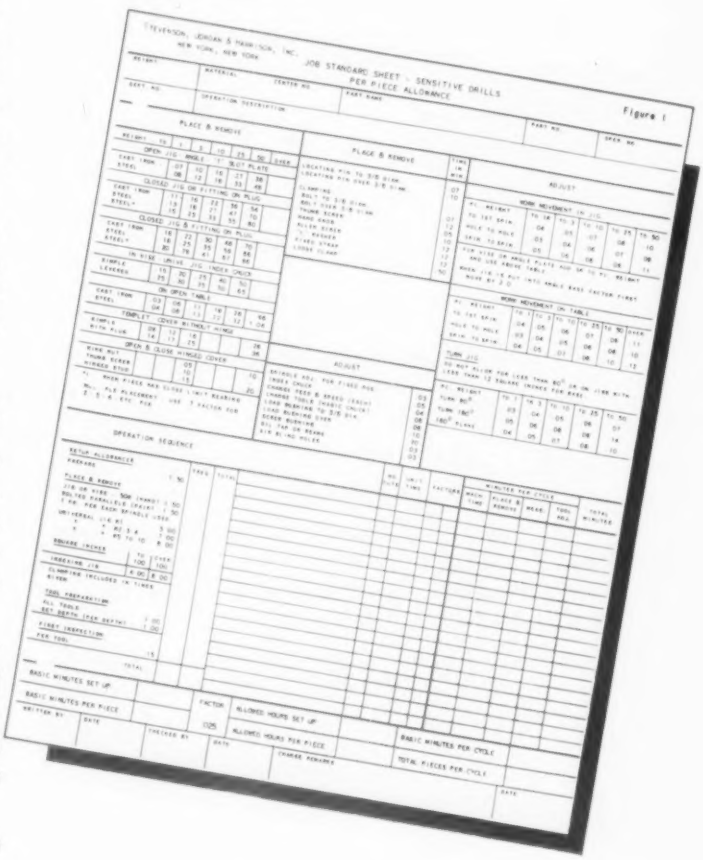
Standard time data is also available for assembly operations in the same detail as for machining. Space does not permit an itemized account of how standard data is derived for use in assembly. Suffice to say that the same principles of element time data are in every day use for assembly operations. See Fig. 2.

Practical Examples

In most companies today, tooling policies are based on the fact that the proposed tools must pay for themselves over a given period of time. Of course, this does not apply where tools are absolutely essential for making the part. However, many tools fall into the category of being self-liquidating because of the economies to be obtained from their use.

Some practical examples are given here to show how this standard time data can be used to accurately forecast these economies.

Fig. 1. Standard time data sheets such as this have been developed for each type of machine tool equipment.



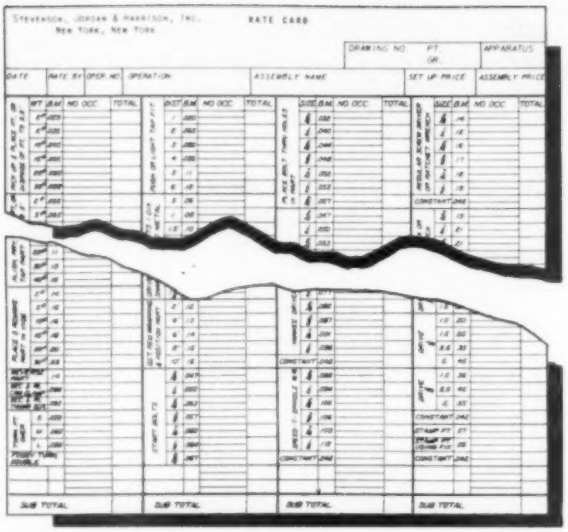


Fig. 2. Shown here is a sample standard time data sheet for assembly operation elements.

Setting Up the Job

Assume that an operation is required on a cast iron casting and that the production planners have decided to use a milling machine for the job. Without making special tools, the job can be done using regular shop equipment and the time required to set up the job may be determined as follows using standard time data.

Set-up Elements	From Standard Data—Time to Set-up (Minutes)
3 Regular clamps @ 1.8 min. each	5.4
1 End stop clamp	1.3
1 Parallel	3.8
1 Arbor and 2 6-in. H.S. Side mills	14.1
Total set-up time	24.6

By making a holding fixture locating from the tee slots in the table of the machine, fixture to have hardened blocks for setting cutters, the time to set up the operation is determined as follows:

Set-up Elements	Standard Data Time (Minutes)
Position and fasten fixture	5.2
1 Arbor and 2 6-in. H.S. side mills (set to fixture)	10.1
Total set-up time	15.3

From this example, it can be seen that the set-up time has been materially reduced through the use of the proper fixture.

The total savings effected, however, must be based on the number of lots run per year, as this saving is made on set-up only. From this time information, the tool engineer may calculate the saving per year on set-up due to the use of the proposed fixture.

Loading and Unloading

On the same operation, using standard time data, it is possible for the tool engineer to calculate the time to load and unload, first, when using no fixture and then when using the contemplated fixture.

No Fixture

Elements of Work		Standard Time (Minutes)
Place work on table		.08
Position		.09
Clamp—3 clamps Unclamp—3 clamps	.29 × 3	.87
Remove work		.04
Total		1.08

Using Proposed Fixture

Elements of Work		Standard Time (Minutes)
Place work in fixture		.08
Position		.05
Clamp (cam lock type) Unclamp (cam lock type)	.06 × 3	.18
Remove work		.04
Total		.35

From these time estimates, it is possible to calculate the savings in time per piece due to the fixture, compared to using only standard department tools. By obtaining the total number of pieces produced per year and multiplying by the saving in time per piece, we obtain the savings per year for handling the piece on this operation.

Feeds and Speeds

When holding the piece on the table using clamps and stops, the maximum feed obtained from the standard data due to lack of rigidity in the set-up is 4 in. per minute. Assuming a length of cut plus over-travel of 6 in., the cutting time per piece, 1.5 minutes, may be readily calculated.

No Fixture

Elements of Work	Standard Time (Minutes)
Cutting Time	1.50
Rapid traverse—advance and return cutter	.18
Engage and disengage feed	.04
Total Time	1.72

By using the fixture, the piece is more rigidly supported, thereby obtaining a feed of 6 in. per minute.

Using Proposed Fixture

Elements of Work	Standard Time (Minutes)
Standard time for cut	1.00
Rapid traverse—advance and return cutter	.18
Engage and disengage feed	.04
Total time	1.22

Savings per Piece Due to Fixture

Loading and unloading		.73 min.
Feeds and speeds		.50 min.
		1.23 min. per piece
Total yearly average production	1500.	
Total yearly savings production	1845. (1)	
Total number of lots per year	30.	
Set-up time saved per lot	9.3 min.	
Total saving in set-up time	279. min. (2)	
Total savings per year	2,124. min. per year (1) & (2)	
Total savings per year	35.4 hrs. per year	

The total cost to make the fixture amounts to approximately $250 and it may be readily ascertained from the above method whether or not it will be advisable to build the fixture. On the basis of these figures, the fixture would pay for itself in about two years. Since this is a standard part it would be worthwhile to make the fixture.

Continuous Operation

If the total production per year were greatly increased, some consideration should then be given to continuous operations.

In this example, this could be accomplished by making use of the circular milling attachment in the machine. A series of fixtures could be mounted around the periphery of the table, and an automatic clamping arrangement could be designed. The fixtures would be loaded and unloaded as the table revolves. At the side of the circular table opposite the loading and unloading stations would be mounted the cutters.

To obtain the time per piece, it would be necessary to refer to the standard time data for loading and unloading. Then the cutting time would be checked against the standard data. The time per piece would be either the cutting time or the loading time, whichever is the greater. This time can then be compared with the time determined previously to see if the savings in time will justify the added cost of fixtures for the continuous operation described.

Measuring Times

By referring to the standard time data tables, the time for measuring and checking the accuracy to required tolerances may be computed. Such calculations will assist the tool engineer in determining whether special gages would be economical and whether or not it is advisable to purchase some of the standard gaging devices on the market.

Experience has shown that too much reliance is placed on the use of the micrometer and other simple gages. Often a special gage will pay for itself in a surprisingly short period of time. Some typical standard time values for measuring are given as follows:

Element	Dimension Checked	Time (Minutes Per Occurrence)
Scale or block gage	Simple	0.08
	Average	0.10
	Complex	0.15
Micrometer	To 2 in.	0.18
	4 in.	0.24
	7 in.	0.30
	10 in.	0.40
Snap gage	To 2 in.	0.07
	4 in.	0.09
	6 in.	0.10
	8 in.	0.11
Plug gage	To 2 in.	0.15
	4 in.	0.25
	6 in.	0.35
Pin gage		0.12
Depth micrometer		0.16
Depth plug		0.14
Feeler gage		0.10
Visual with contour, radius or form gage		0.17
Bench protractor or square		0.35

Standard Practice Instructions

The final outcome of the use of standard time data is the engineering practice instruction book. Such a book in the hands of all engineers, i.e., designers, tool or process engineers, makes the entire organization cost-minded. It steers each individual concerned with the ultimate results in cost and production toward using the best fabricating and assembly methods possible under a wide variety of operating conditions. One company employs six process engineers to look over all drawings using standard practice instructions and standard data before releasing drawings for manufacture.

American Standard Tolerances for Ball and Roller Bearings*

Introduction

In order to assure users of standards of precision for proper application of ball or roller bearings in all types of equipment, four classes of tolerances have been established for ball bearings, two for cylindrical roller bearings, and one for spherical roller bearings. These are known as ABEC-1, ABEC-3, ABEC-5, ABEC-7, RBEC-1 and RBEC-5 tolerances. The ABEC-8 is the most refined. All four classes include tolerances for bore, outside diameter, ring width and radial runouts of inner and outer ring. To the ABEC-5 and ABEC-7 have been added tolerances for parallelism of sides, side run-out and groove parallelism with sides. All tolerances apply only if measured in agreement with the American Standard Gaging Practices for Ball and Roller Bearings, B3.4-1950.

Inch-Millimeter Conversion Factor

Because the majority of bearings is made to metric dimensions and the tolerances are in inches, it is necessary to use a common conversion. The following factor (American Standard Practice for Inch-Millimeter Conversion for Industrial Use, B49.1-1933) is used; 1 in. = 25.4 mm. Therefore, the conversion tables given in the American Standard B48.1-1933 should be used in the manner indicated by this standard, or if no conversion tables are available, equivalents should be calculated by use of the factor 25.4. To convert inches to millimeters, multiply the inches by 25.4. To convert millimeters to inches, divide the millimeters by 25.4.

When a decimal value is to be rounded off to a lesser number of places than the total number available, the procedure should be as follows:

(a) When the figure next beyond the last figure to be retained is less than 5, the last figure retained should not be changed.

(b) When the figure next beyond the last figure to be retained is more than 5, the last figure retained should be increased by 1.

(c) When the figure next beyond the last place to be retained is exactly 5 with zeros beyond, the last figure retained, if even, should be unchanged; if odd, it should be increased by 1.

***This standard, designated B3.5-1951, is the second of a series of antifriction bearing standards under development by a committee representing 14 trade associations, technical societies and the U. S. Army and Navy. Establishing tolerances and limits of size governing dimensional interchangeability of various types of bearings, the standard includes 15 tables specifying tolerances on the bore, outside diameter, width and other characteristics of a bearing in different grades of accuracy required for various bearing applications.**

American Standard Tolerances for Ball and Roller Bearings

(Continued)

Table 1—ABEC-1, RBEC-1 Annual Ball, Cylindrical, and Journal Roller Bearings, Except Magneto Bearings. Tolerances in 0.0001 Inch.

Inner Ring

Bore				Tolerance for Bore				Radial Runout (Total Indicator Reading)
Mm		Inches		Average d_m		d min	d max	
Over	Incl	Over	Incl	Low	High			
0	9	0	1/4	−3	+0	−4	+1	3
9	18	3/8	5/8	−3	+0	−4	+1	4
18	30	3/4	1 1/8	−4	+0	−5	+1	5
30	50	1 1/4	1 1/2	−5	+0	−7	+2	6
50	80	...	...	−6	+0	−8	+2	8
80	120	...	...	−8	+0	−11	+3	10
120	180	...	...	−10	+0	−13	+3	12
180	250	...	...	−12	+0	−16	+4	16
250	315	...	...	−14	+0	−18	+4	20
315	400	...	...	−16	+0	−20	+4	24
400	500	...	...	−18	+0	−23	+5	26

Outer Ring

Outside Diameter				Tolerance for Outside Diameter				Radial Runout (Total Indicator Reading)
Mm		Inches		Average D_m		D max	D min	
Over	Incl	Over	Incl	High	Low			
0	18	0	5/8	+0	−4	+1	−5	6
18	30	3/4	1 1/8	+0	−4	+1	−5	6
30	50	1 3/8	1 7/8	+0	−5	+2	−7	8
50	80	2	2 5/8	+0	−5	+2	−7	10
80	120	...	...	+0	−6	+3	−9	14
120	150	...	...	+0	−8	+3	−11	16
150	180	...	...	+0	−10	+3	−13	18
180	250	...	...	+0	−12	+4	−16	20
250	315	...	...	+0	−14	+4	−18	24
315	400	...	...	+0	−16	+4	−20	28
400	500	...	...	+0	−18	+5	−23	32
500	630	...	...	+0	−20	+6	−26	40

Bearings Other Than Duplex
Width of Individual Inner or Outer Ring

Nominal Bore			Width Tolerance	
Mm				
Over	Incl	Inch Type	+	−
0	180	All Sizes	0	50
180	315		0	100
315	400		0	160
400	500		0	180
500	630		0	220

Duplex Bearings*
Total Width of Inner or Outer Rings

Nominal Bore			Width Tolerance	
Mm				
Over	Incl	Inch Type	+	−
0	80	All Sizes	0	200
80	180		0	300
180	315		0	400
315	400		0	500

*If other than a pair of bearings is involved, the tolerance is in proportion to the number of bearings.

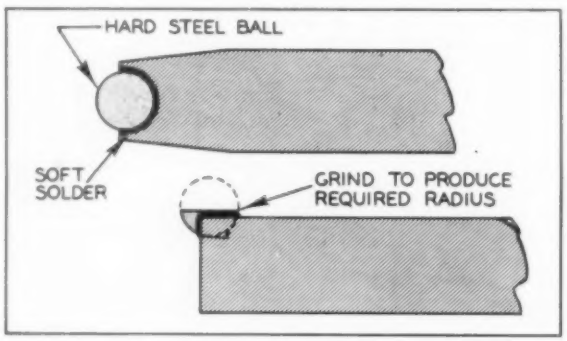
Gadgets

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

Radius Groove Forming

When it becomes necessary to form a radius groove in a turned piece, it is usually necessary to accurately form-grind a tool to the radius desired. This operation, when amortized over a short-run job, is quite expensive. The method described here has proved satisfactory at much lower cost.

A hardened steel ball whose radius is equal to or larger than the radius to be cut is set with soft solder into a shallow hole drilled in the end of a cold rolled steel piece which serves as a tool holder as shown. The tool is then set in a surface grinder and the ball is ground flat until, by measuring across the maximum diameter which is left after grinding, the diameter is found to be exactly twice the radius to be formed.



Since a considerable amount of grinding stock taken off near the center of the ball will produce a relatively small change in the diameter, the diameter can be established extremely accurately, and since steel balls are usually ground and lapped to very close spherical dimensions, a perfectly true radius will always be obtained. The nickel chrome steel used in hardened balls will hold a cutting edge long enough for a small production run, and if the tool is kept cool so that the solder does not soften, no trouble will be experienced with the solder holding the ball to the shank of the tool.

P. H. Winter
Syracuse, N. Y.

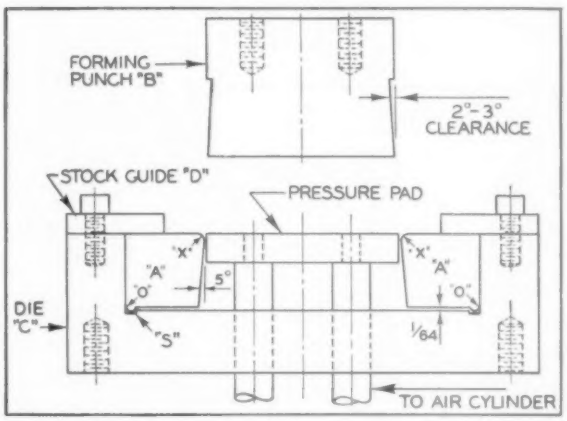
Diamond Dresser Point Protectors

Because of the scarcity of diamonds, it was found necessary to give diamond-pointed tools more than the ordinary amount of protection. Eraser caps, such as are used on the ends of pencils, when slipped over single point dressers, proved to be a very inexpensive and practical solution to the problem.

Klaus L. Schlesinger
Los Angeles, Calif.

Forming Die

Shown here is a forming die that will give a full 90-deg bend in one operation by adding two pivot jaws (A). These jaws are machined from standard ground tool steel with standard milling cutters. The ⅛-in. pivoting radii (O) on the jaws are milled with a standard ⅛-in. concave half-circle cutter. Pivot seats (S) on the die block are milled with a ⅛-in. slotting saw, allowing 1/64-in. clearance for pivoting jaws (A) to swing inward.



It is important that the forming radii (X) on the pivot jaws be machined to approximately the same dimension as the thickness of the stock to be formed. Too large a radius will not give a full 90-deg bend.

As the punch (B) descends and contacts the stock, the pivot jaws (A) are forced back momentarily to the shoulders on the die (C). As usual, an indent is made in the stock at this instant, which forces the pivot jaws inward and irons the stock against the sides of the punch, which is given a two- or three-degree taper to allow for springback, depending on the type and thickness of the stock being formed. The indent will be ironed out, producing a neat bend.

The stock guide (D) can be milled so as to cover part of the pivot jaws on the die. No other means of holding the pivot jaws are necessary. The jaws can be designed to make several bends in the same panel or angle part by fitting suitable sections into the die. The pivot jaws should be hardened for best results.

Daniel L. Mather
Malden, Mass.

The Tool Engineer pays regular page rates for accepted contributions to these pages, with a minimum of $5.00 for each item.

Cutting Fluids

Selection and Application

By Robert T. Kimmel

With the current trend in the metalworking industry towards higher machine feeds and speeds, the function of cutting fluids in the process of metalworking has become more and more important. Modern metals and the tools and machines with which to work them have been the result of intensive research and development. In like manner, investigation of cutting fluids has led to the introduction of several new cutting fluids as well as considerable improvement of the products in general use.

In order to understand the function of the cutting fluid in the machining process, some knowledge of what happens when metal is removed is necessary. Considerable research has been done and according to most authorities today, chip formation in metalworking is a process of shearing off metal from the workpiece. The shearing action of the metal produces intense heat, and this is further augmented by the heat generated by friction between the tool face and the chip sliding over its surface. According to Ernst, even the average temperature over the apparent area of contact of chip and tool face is on the order of 1000 deg F or more with pressures on the order of 100,000 lb per square inch. Other sources cite this pressure as being as much as 400,000 lb per square inch.

Functions of a Cutting Fluid

The cutting fluids used in a metalworking operation have two primary functions. The first is to remove some of the heat generated in the process by cooling the tool and workpiece. The second is to lubricate the surfaces of the tool and chip so as to reduce the friction between these surfaces, thus reducing the amount of heat generated.

Fig. 1. Machining collars for bushings.

At the extremely high pressures and temperatures present at the point of cutting, it is impossible to maintain a continuous film between the chip and the tool face and metal-to-metal contact occurs. As a result of the high temperatures and pressures, the two surfaces are welded to each other. Lubrication is achieved by the amounts of cutting fluid which enter the microscopic spaces in the surfaces of the two metals.

If the cutting fluid performs these two primary functions, the results will be increased tool life and a better surface finish. Incidental benefits include greater dimensional accuracy, which is achieved because deformation due to heat is limited, and removal of the chips from the working area. The last item is not usually important except in certain operations where an accumulation of chips may impede the work. Tool life is also increased.

Fig. 2 (left). Milling cylinders for truck engines on a multiple milling machine. Fig. 3 (right). Machining a coupling from a steel forging on a turret lathe.

Cutting Fluid Constituents

The principal constituents of cutting fluids are water, mineral oils, vegetable or fatty oils and chemicals (synthetics). Water is a very efficient cooling agent but it is very seldom used alone because of its corrosive effect on materials and machine parts. On the other hand, oil is excellent as a lubricant but does not possess cooling properties approaching those of water. Fatty and vegetable oils were first used for lubrication, but after petroleum derivatives became available, mixtures of the two became common because of the high cost of the fatty oils and their tendency to turn rancid.

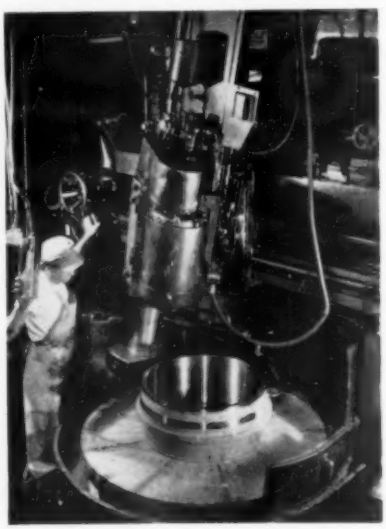
As the demands on cutting fluids became more stringent with the introduction of newer and harder metals and the need for higher speeds and feeds, chemicals were added for the benefits to be derived. Sulfur in its active form, chlorine compounds and other chemicals are now used for the special characteristics they impart to the cutting fluid.

Emulsions

The character of the work done in numerous metalworking operations is not sufficiently severe to require considerable lubrication, but adequate cooling is vital. Grinding is a good example, as is the use of carbide-tipped tools for light cuts at high speeds. For work of this type there has been developed the soluble oils which are usually a combination of straight mineral oils and some type of soap. The soaps used today are mostly sulfonates of petroleum or some other emulsifying agent. When mixed with water, the soluble oils form an emulsion which is the common milky type of coolant found in most metalworking shops.

These emulsions are relatively stable under most conditions, but it is extremely important that the amount and kind of each ingredient be carefully measured for the particular job on which it is to be used. Germicides are sometimes added to inhibit the growth of bacteria, and a deodorant may also be included. The amount of water added to the soluble oils, varying from 4 to 80 or more parts, depends upon the amount of lubrication and rust protection required.

Fig. 4. Grinding the outside diameter of a double mill bearing cone.



A good quality soluble oil will emulsify readily with most waters, will form a stable emulsion, will not turn rancid, is not injurious to operators or machines, prevents corrosion, and does not form gum on the machines. Since the emulsion is of the oil-in-water type, it is important that the oil be poured into the water. The mixture should be agitated during the addition of the oil to the water, and a temperature somewhat in excess of 40 deg F will facilitate the process. In some cases it will be necessary to treat especially hard water in order to form a satisfactory cooling solution.

Cutting Oils

Straight cutting oils are used where the primary consideration is lubrication, with cooling secondary. These can be mineral oils alone, or combinations of mineral oils and fatty or vegetable oils, depending on

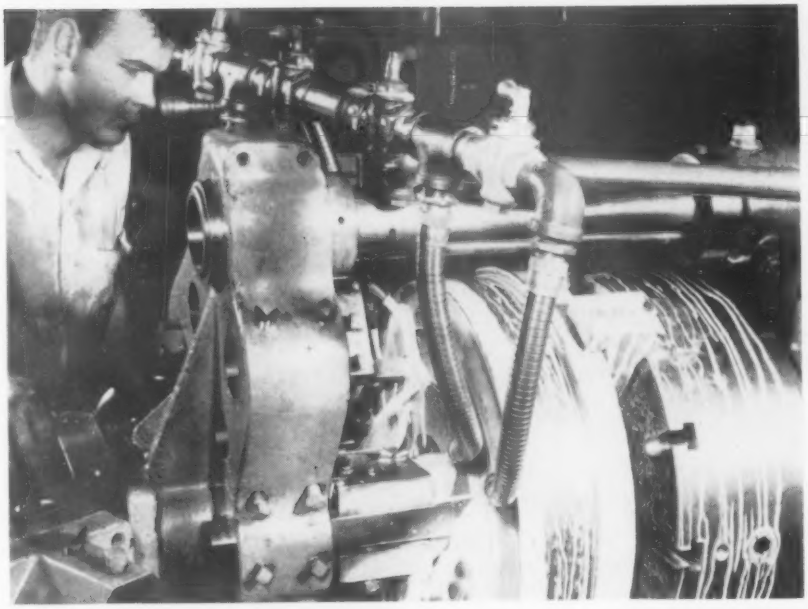
the nature of the work. In addition, chemicals are sometimes added for special purposes. The most widely used oils of this latter type are the sulfurized oils.

The great majority of these oils are dark-colored products which obscure the tool and workpiece and prevent quick inspection of the finish. This is objectionable, particularly in precision turning, tapping, threading, gear cutting, grinding and milling. Precision work requires close control by the operator and visibility at all times of the tool and the working area, and the finish being secured. For this purpose a transparent oil whose film permits such observation is used.

Sulfurized Oil

Because of the extremely high pressures and temperatures present as the hot chip slides over the tool face, there is a tendency for the two surfaces to be welded to each other. At about the time of World War I it was discovered that the addition of a certain amount of sulfur compounds to cutting oils minimized this tendency. It is generally assumed that the sulfur compounds function by establishing a sulfide film between the two surfaces. The amount of sulfur added to the oil must be carefully controlled since too much of the substance causes excessive tool wear. The material being machined must also be considered since the chemicals in the oil will react with copper, brass and other alloys and may ruin the workpiece.

Where sulfur alone is not satisfactory as an additive, compounds



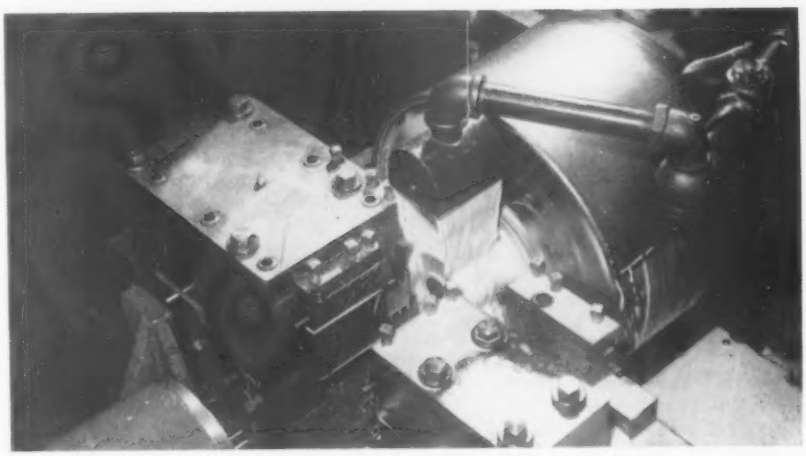


Fig. 5. A chuck body being machined on a turret lathe. Note that four cutters are working at the same time and the coolant is being directed on each of the four surfaces being machined.

Fig. 6. A hydraulic automatic lathe performing the first turning operation on a forged coupling blank. The "cup type" coolant distributing arrangement supplies adequate fluid for the simple facing and turning operation.

Fig. 7. Shown here are crankshafts being machined.

Fig. 8. A large vertical broach in operation in an automobile plant.

containing chlorine, and sometimes a small amount of phosphorus, may be used for difficult operations on the harder metals. These additives are called EP or extreme pressure agents.

Chemical Compounds

Research in recent years in the cutting fluid field has produced a number of new materials for use in machining operations. These compounds are not petroleum derivatives nor are they emulsions of soluble oils and water. Several companies have introduced products under trade names which are composed of chemicals.

As with soluble oils, these compounds are mixed with water for use at the machine. The droplets are said to be smaller and enter more closely into the metal-cutting operation. In some cases, the high pressure present between the tool face and the chip solidifies the chemical in the cutting fluid in the tiny spaces on the tool and chip surfaces. The chemical has a low shear strength and supplies chemical lubrication, thus reducing the amount of heat generated by the friction of the chip moving across the tool face.

The manufacturers claim superior wetting properties for these compounds, which causes them to adhere more closely to surfaces. This serves to protect machine parts from corrosion, since a thin film of the fluid coats the surfaces exposed to it. In case histories illustrating the use of these newer fluids, it has been demonstrated that feeds and speeds can be increased appreciably, while at the same time tool life has also been lengthened.

Choosing a Cutting Fluid

Since the selection of the cutting fluid for a machining operation is fully as important as the choice of the tool, care must be exercised that the selection is the right one for the job at hand. The two primary considerations are cooling and lubrication, and other factors are incidental, if not in many instances dependent upon, the proper performance of the first two functions.

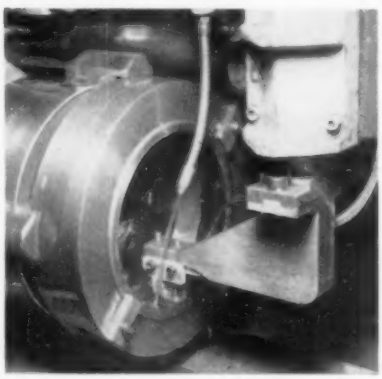


Fig. 9. A Superfinishing Machine is shown here with a pinion gear as the workpiece. In this case a lubricant (not a coolant) is being distributed over the work surface. The area contact of the superfinishing stone generates no measurable heat and, therefore, no coolant is necessary. The lubricant, which consists of a special compound mixed with kerosene, washes away the minute particles of metal removed during the process.

Each operation should be studied, using the general recommendations available, to find the particular cutting fluid needed for the specific job. Among the elements to be considered are speeds, feeds and depth of cut; the finish desired; costs; type and uniformity of material; type of tools and how they are ground; condition of machine; atmospheric conditions; method of application of the fluid; the operator.

The following general recommendations will apply to most operations unless there is some special feature to be considered. They should be used as a guide only.

Sulfurized mineral oil, preferably one that contains some chlorine of the proper concentration will be advantageous in many cutting operations on nickel steel, and in threading operations on most ferrous metals. For threading operations on nickel steel, and ductile steels generally, a sulfochlorinated oil containing a saponifiable material will often prove superior. The latter, if of the transparent type, will also be selected for certain steel cutting operations where visibility is an important factor.

Mixtures of mineral oil and lard, or other saponifiable material, in various proportions, are occasionally preferred for the less severe cutting and drawing operations, particularly where an oil is required that is not likely to stain the work.

Oil-water emulsions are frequently used for grinding operations to prevent distortion, assure accuracy, and because they permit the grinding wheel to bite into the metal. They are also often selected for machining operations involving conditions where the need of a first-rate cooling medium at a low price transcends all other considerations.

General recommendations are sometimes risky, but as a rule, machining operations on steel which produce a curling chip that bears heavily on the face of the cutting tool indicate a tough material which requires a fluid possessing high anti-weld and anti-friction properties for satisfactory production. If the chip bears hard but breaks off just above the tool face, a fluid of more moderate extreme pressure properties may be used. Brittle material, such as cast iron, which does not form chips which bear heavily on the tool, may be cut dry or with an oil-water emulsion if it is desired to keep the dust down.

The four types of stainless steels, ductile, self-hardening, free-machin-

ing and heat-resisting, are particularly hard to machine. The sulfochlorinated-mineral oil type of cutting fluid is recommended here.

Table I present in tabular form a summary of these general recommendations for steel, alloys and the other more commonly used metals.

Cutting Aluminum

One of the more important metals other than the ferrous metals used in metalworking is aluminum. This metal can often be dry-machined satisfactorily, but with heavy cuts and feeds, excessive heat is produced and a cutting compound becomes necessary. This cutting compound should be essentially a coolant, and for this purpose, soda water, or a lean, soluble oil solution is generally acceptable. In some cases, it may be desired to add a small amount of lard oil or kerosene. The Aluminum Co. makes the following recommendations:

1. Straight mineral oils having a viscosity of about 60 seconds Saybolt universal at 100 deg F are relatively inexpensive and yield good results.
2. Additions of from 5 to 10 percent of a fatty oil, such as lard oil, will improve the performance of the straight mineral oil.
3. Special oils produced by the proprietary companies for machining aluminum give excellent results.
4. Equal parts of lard oil and kerosene make a good lubricant. These proportions can be varied to meet the requirements of a wide range of machining operations.
5. Heavy cuts and feeds as encountered in heavy roughing cuts and tapping operations require the use of higher viscosity lubricants.

Application of Cutting Fluids

A steady stream of cutting fluid at low pressure should be directed to the workpiece and cutting tool. The quantity of fluid should be sufficient to insure a constant copious supply at the point of cutting. The low pressure is recommended since the fluid absorbs more heat per unit volume and maintains the workpiece at a more uniform temperature. High pressure causes splashing and sometimes the fluid misses the critical point of application.

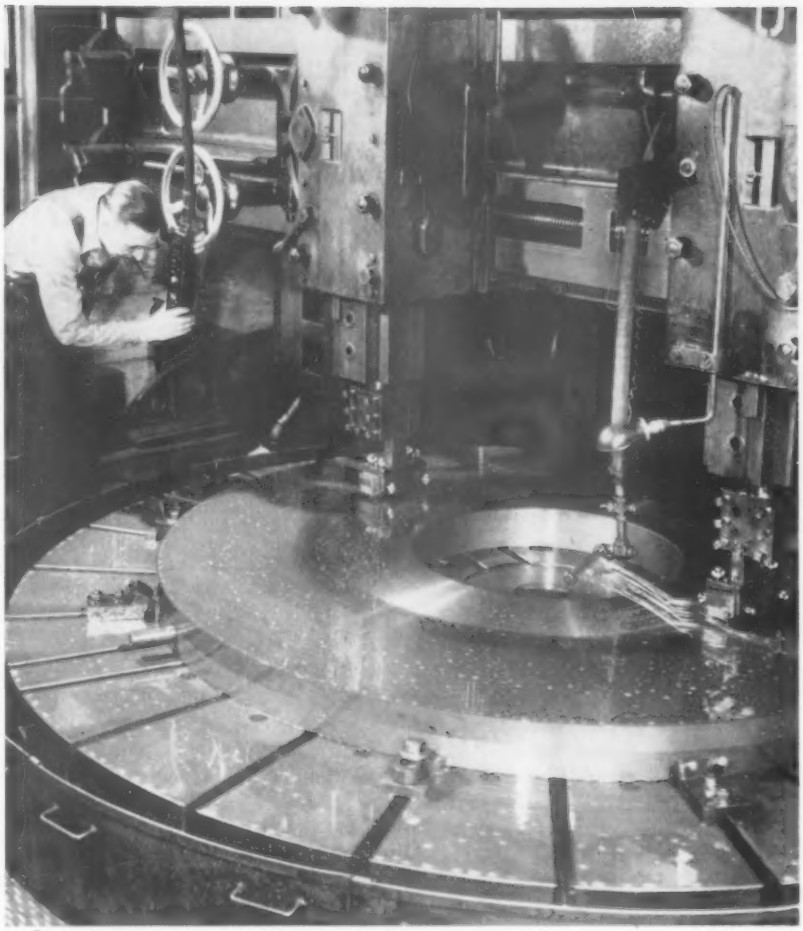


Fig. 10. A mirror-smooth finish is put on the rotating element of a hydro-generator thrust bearing in this final grinding operation. The bearing must support a load of almost two million lb, including the weight of all rotating parts of the generator and hydraulic turbine, plus the thrust of the turbine. The superfine polished surface is necessary to establish a film of oil which separates the rotating element of the bearing from the stationary part.

There are two exceptions to this general rule. In the case of high speed thread, gear or form grinding machines using oil instead of an emulsion as a grinding fluid, sufficient pressure should be used to force the oil to the point of work contact and to penetrate the wheel surface while it is turning rapidly. Again, with cemented carbide tools, the fluid should be applied under sufficient pressure to force it to the point of contact between the work and the tool, so that coolant flow is not interrupted by the chip. Because of the rapid heat development in the tool at the high speeds employed with carbides, any sudden change in temperature due to intermittent flow will tend to form cracks in the tool, leading to ultimate breakage.

Storage and Handling

Adequate storage space must be provided for the cutting oils and fluids where they will not be subject to temperature extremes in order to preserve their stability and chemical composition. Extreme cold increases the viscosity of the oils and makes them difficult to mix.

Table I—Metal-Cutting Fluid Recommendations*

OPERATION	STEEL				Cast iron	Brass	Bronze	Copper	Aluminum	Magnesium	Nickel	Monel
	To 0.30C	0.30C and up	Alloy	Stainless								
1. Broaching	Type 8	Type 10	Type 10	Type 10	Type 5	Type 2	Type 3	Type 2	Type 3	Type 2	Type 8	Type 8
2. Tapping and threading	Type 7	Type 8	Type 8	Type 10	Type 5	Type 2	Type 3	Type 4	Type 3	Type 3	Type 8	Type 8
3. Hobbing and gear cutting	Type 7	Type 8	Type 10	.....	Type 5	Type 2	Type 3					
4. Gear shaving	Type 8	Type 4	Type 4	.....	.....	Type 2	Type 3					
5. Drilling and reaming	Type 7	Type 8	Type 8	Type 10	Type 5	Type 5	Type 5	Type 5	Type 2	Type 2	Type 8	Type 8
6. Turning	Type 5	Type 11	Type 11	Type 11	.....	Type 5	Type 5	Type 5	Type 5	Type 2	Type 5	Type 8
7. Boring	Type 5	Type 5	Type 11	Type 11	.....	Type 5	Type 5	Type 5	Type 5	.....	Type 5	Type 8
8. Automatic screw machining	Type 7	Type 8	Type 9	Type 10	.....	Type 2	Type 3	Type 2	Type 3	Type 2	Type 8	Type 8
9. Milling	Type 5	Type 5	Type 11	Type 11	Type 5	Type 5	Type 5	Type 5	Type 2	Type 2	Type 8	Type 8
10. Thread rolling	Type 1	Type 3	Type 8	Type 8	.....	Type 1	Type 2	Type 1	Type 2			
11. Sawing	Type 5	Type 5	Type 5	Type 5	Type 5	Type 6	Type 6	Type 6	Type 5	Type 2	Type 5	Type 5

* From Metalworking Lubricants, by E. L. H. Bastian. Copyright 1951, McGraw-Hill Book Co.

Since the cutting fluids are generally used over and over again, it is of paramount importance that they be kept clean. The oil or fluid from each machine should be collected periodically, either by the batch method or by a central system, and cleaned and sterilized. This will remove chips and abrasives which might affect the finish of the workpieces, and will also prevent the growth of infectious bacteria with which the oil may have been contaminated.

Supervision of the composition and quality of the fluids is necessary to maintain the correct standards. Careful observation will often be satisfactory, but in some cases laboratory analysis will be required to maintain uniform performance.

Sanitary Precautions

The operators on many machining operations, because of the nature of the process, come in contact with the cutting fluid. Care must be exercised, therefore, that the cutting fluid is kept sanitary and free from bacteria and abrasives which may affect the skin of the operator. Proper installation of the cooling system, filters, sterilizers, splash guards, etc., can eliminate this.

Personal cleanliness, however, is the major factor in controlling and preventing skin infections arising from contact with the cutting fluids. Workmen should be taught hygenic practices and the reasons for them. Most manufacturers sterilize their products before shipment, but machines, operators, tanks and piping are all sources of contamination. The best method to prevent this contamination is cleanliness and good housekeeping in the shop.

Effective disinfection of the cutting fluid can be accomplished by heating the oil or emulsion to a temperature of 140 to 180 deg F for a period of 25 minutes to one hour. Oils alone can be heated to higher temperatures, but emulsions, which lose some of their constituents when subjected to high temperatures, can be held at a pasteurizing temperature of 140 deg for half an hour.

In recent years, manufacturers have developed germicides which can be added to the cutting fluids. It is now claimed that although a small percentage of phenol, which in itself is harmful, is present, the resulting chemical compounds are virtually free from the objectionable characteristics of phenol. Germicides should be used only under carefully controlled conditions and with competent supervision.

Table II—Types of Cutting and Grinding Fluids

Inactive Oils and Fluids:

- Type 1. Light-viscosity mineral oil, 100 to 200 SSU at 100° F
- Type 2. Mineral-fatty oil blend
- Type 3. Mineral oil compounded with sulfurized fatty oil
- Type 4. Fatty oil such as lard oil
- Type 5. Soluble-oil emulsion of oil-in-water type
- Type 6. Soap solution

Active oils and fluids:

- Type 7. Sulfurized mineral oil
- Type 8. Sulfurized mineral oil compounded with fatty oil
- Type 9. Sulfochlorinated mineral oil
- Type 10. Sulfochlorinated mineral fatty oil
- Type 11. Heavy-duty soluble oil (active-additive type)

Credits

D. A. Stuart Oil Co.
Cities Service Oil Co.
Esso Standard Oil Co.
General Electric Co.
Allis Chalmers Manufacturing Co.
Gisholt Machine Co.
Standard Oil Co. (N.J.)

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Cover

A drilling and facing operation on a transmission gear at the Ford Motor Co.

Plant Tours:

Chicago At Work

By Nancy L. Morgan

Outstanding manufacturing companies in the Chicago area are opening their doors to ASTE visitors for plant tours during the Industrial Exposition Week, March 17-21.

The following firms are already scheduled by the plant tour committee.

Clearing Machine Co.
Electro Motive Div. of General Motors Corp.
Kropp Forge Co.
Lindberg Steel Treating Co.
Motorola, Inc.
Scully-Jones and Co.
Thor Corp.
United States Steel Corp.

The final number of companies participating in the tour program is expected to reach 12 before final plans are completed by Robert Osborn and Fred Rust of the Chicago chapter's show committee.

The blast furnaces, open hearth furnaces, Bessemer converters and rolling mills of the South Chicago plant of the United States Steel Corp. will be inspected by at least 150 members of the Society.

The South Works, third largest steel mill in the world, occupies 574 acres located in South Chicago along the lake front. It has an annual capacity of 4,675,000 net tons of steel.

ASTE visitors will be given two opportunities to see machinery operations at the Thor Corp., manufacturers of household appliances. The plant tour will start in the modern mechanical grey iron foundry which has a capacity of 50 tons per day.

The punch press and sheet metal departments and the assembly lines for automatic and semi-automatic washing machines are included on the tour. Also scheduled are the testing and inspection sections.

Top photograph—United States Steel Corp. Below—Kropp Forge Co. (left) and Clearing Machine Co.

Lindberg Steel Treating Co., headed by the son of the founder, is providing two tours for Society members. The plant covers 75,000 square feet and employs 335 persons. Besides the usual heat treatments of steels, the firm also treats all types of metals.

The complete die sinking department and modern heat treating furnaces are among the attractions at the Kropp Forge Co. Visitors will study flat die, drop and upset forging equipment. The complete machine shop for machining forgings of all sizes, laboratories and inspection departments are also included on the tour.

The production of television sets, radios and other communications equipment will be the highlight of the tour through Motorola, Inc. The flow of materials from the receiving department until the finished products are turned out on the assembly line will be shown on the tour route. A movie and a question period are scheduled.

(Continued on page 68)

Front row (from left): Mrs. Gordon J. Benes, Mrs. Thomas C. Barber, Mrs. Clare Bryan, Mrs. Richard W. Miller, Mrs. Walter W. Haskins, Mrs. Marshall A. Blue and Mrs. Anton J. Schwister. Back row: Mrs. E. W. Ostrom, Mrs. Carle E. Schmitz, Mrs. Harry R. Nelson, Mrs. Clifford E. Ives, Mrs. Jerry Tannenbaum, Mrs. Frank A. Leone, Mrs. Alvin L. Winkler and Mrs. B. A. Fleury, Jr.

Chicago Committee Schedules Ladies' Activities

A wide variety of activities—a luncheon, tours, visits to radio broadcasts—is scheduled on the ladies' program at the ASTE Industrial Exposition and 20th Annual Meeting.

The program committee, under the direction of Mrs. Richard W. Miller, has planned a tour of the Conrad Hilton Hotel, formerly the Stevens, for Monday morning, March 17. That afternoon, ASTE wives will visit the famed Art Institute of Chicago.

Tuesday's agenda includes a sightseeing tour of Chicago and a tour of the Chicago Museum of Science and Industry.

Marshall Field's Wedgewood Room will be the setting for a luncheon and fashion show at noon, Wednesday, March 19. Depending on individual preference, visitors will tour the store or go out to the Chicago Historical Society in Lincoln Park in the afternoon.

Don McNeil's Breakfast Club radio broadcast will be a major attraction on the Thursday program. Also included is a visit to the "Design for Living" exhibit at the Merchandise Mart.

A tour through the Sears, Roebuck and Co. mailing division and testing laboratory has been arranged for Friday morning. Visits are scheduled that afternoon to the Chicago Natural History Museum and Shedd Aquarium.

Additional tours have been planned to points of interest outside the Chicago area and the Board of Trade, the Tribune Building and the Chicago Midway Airport.

Tickets to radio and television broadcasts will be made available. Card games are planned in the ladies' lounge at all times for those not wishing to participate in other activities.

Assisting the Chicago committee are ASTE wives from Milwaukee and the Fox River Valley chapter. Mrs. Roger Waindle of Muskegon is also working on the committee.

Chicago members of the group, in addition to Mrs. Miller, are: Mrs. Thomas C. Barber, first assistant chairman; Mrs. Marshall A. Blu, second assistant chairman; Mrs. George W. Steinmetz, secretary; Mrs. Walter W. Haskins, registration and reception; Mrs. Arnold W. Blackshaw, publicity.

Other committee members are Mesdames Fred J. Schmitt, Clifford E. Ives, Harry R. Nelson, Cecil C. Waldo, Harry A. Paine, Anton J. Schwister, Gordon J. Benes, Clare Bryan, E. W. Ostrom, Alvin L. Winkler, Frank Leone.

Also planning activities are: Mesdames A. H. Ettinger, Jerry Tannenbaum, Albert W. Grove, Carl E. Schmitz, B. A. Fleury, Jr., J. H. Verne Loeppert, Donald J. O'Boyle and Irving Laity.

Marshall Blu Retires From Sears, Roebuck & Co.

Marshall A. Blu, director of tool and hard lines production development for Sears, Roebuck & Co. since 1935, has retired from his position, it was announced early in December.

Mr. Blu, a member of the Society for the past 15 years, is chairman of Chicago chapter's show committee for ASTE's Industrial Exposition being held in March.

He has spent 36 years in the tool and production engineering field as a teacher and engineer and plans to become a consulting engineer following an extended vacation in Florida.

During his professional career, Mr. Blu served as instructor in Purdue University's department of practical mechanics for six years and as a tool engineer for General Motors Corp. and Packard Motor Car Co.

Chicago at Work

(Continued from preceding page)

Five tours will be taken by ASTE members through Scully-Jones and Co., designers and manufacturers of standard and special machine tool accessories. On its list of products, sold all over the world, are adjustable adapters, micro nuts, boring bars, boring mill tools, core drills, countersinks, drill chucks and many other tools.

The Clearing Machine Corp., manufacturers of mechanical and hydraulic presses, will play host for several tours through their plant. This corporation has built some of the largest presses manufactured in the United States, including a hydraulic press of 16,000 tons capacity and mechanical presses up to 4,000 tons capacity.

The tour at Clearing will show interesting solutions to problems encountered in running through a piece which is 30 feet long, 10 feet high and weighing 60 to 70 tons.

New Developments in Plastics Discussed

Ft. Wayne, Ind.—Two executives from Barrier and Pribble Plastic Co., Inc., presented a program on plastics before the Ft. Wayne chapter November 14. The meeting at the Chamber of Commerce building was attended by 35 members.

Speakers were Wayne I. Pribble and Alvie L. Barrier, who spoke on "Tooling for Plastics" and "New Developments in Plastics."

WIN A HANDBOOK

Every ASTE member is being given the opportunity to submit questions to be answered at the panel discussions taking place at the 20th Annual Meeting in Chicago. *Tool Engineers Handbooks* will be awarded for the three best questions submitted to each discussion panel.

Mailings are going out to the entire membership of the Society asking for topics to be discussed at the technical panels on turning and forming tolerances, drilling, metal stamping dies and operations, finish grinding, machine drives and controls.

A questionnaire to be filled out and sent to the technical director of ASTE was enclosed. If additional space is needed, use a separate sheet of paper for each question and indicate the discussion panel to which the question should be directed.

Taking oath of office (from left) are: Ken King, Earle Wellman, George W. Kennedy, Gordon Page, Len Hansler, Robert Dyer. Administering officer is L. B. Bellamy.

Society Charters Peterboro Chapter; Leslie B. Bellamy Swears in Officers

ASTE's Peterboro chapter is the 94th addition to the expanding roster of the Society.

At the Charter Night held November 16 in Peterboro, Ont., Canada, 74 members were officially welcomed by National officers and representatives from other ASTE chapters. More than 150 persons attended the banquet at the Kewartha Club.

The charter was presented by Robert B. Douglas, past president from Montreal. In his address, Mr. Douglas described the tool engineer as "the architect of his country's future."

L. B. Bellamy, national director from Detroit and first vice president of the Society, swore in the Peterboro officers.

Chapter Officers

Serving the current term are: Chairman Robert Dyer, First Vice Chairman Leendert Hansler, Second Vice Chairman Gordon Page, Third Vice Chairman George Kennedy, Secretary Earle H. Wellman and Treasurer Kenneth King.

In a brief speech, W. B. McClellan, national director from Detroit, presented a metallic ASTE emblem to the chapter and announced that all chapter chairmen would be invited to the official dedication of the National Headquarters Building in 1953.

A presentation was also made by A. B. Clark, chairman of the National Membership Committee from Cleveland, who gave a membership kit to Mr. Page.

Whitehall Receives Gift

A gift showing the appreciation of the Peterboro members was given to Harry Whitehall, area membership captain, who directed the organizational work necessary to the formation of the chapter. He held many meetings over a period of months to lay the groundwork for the new chapter. Early in November, officers were elected, the activities of the Society were explained in detail and ASTE services outlined.

Peterboro Chairman Dyer welcomed the guests and extended an invitation for a repeat visit to the chapter.

T. J. Donovan, third vice president and national director from Philadelphia, entertained the group with his widely acclaimed "Silver Dollar Quiz." More than 100 United States silver dollars, encased in leather bearing the chapter's name and number, were awarded to the contestants. In appreciation for his program, members gave Mr. Donovan an electric clock as a remembrance of the evening.

Charter Nights Guests

Other guests at the Charter Night included: G. A. Rodgers, area membership captain from Montreal and secretary of the National Membership Committee; Fred Lockhart, Toronto chapter, F. A. Dunne, Niagara District chapter and D. M. McCurdy.

Many congratulatory telegrams and letters were received from chapters and representatives of the Society. Donations for the new treasury were sent by Hamilton, $50; Toronto, $50; London-St. Thomas, $25; Grand River Valley, $15.

A *Tool Engineers Handbook*, given by Niagara members, was awarded as a door prize.

Personal contributions were received from Harry Sehl, chairman of the Grand River Valley chapter, and Ben Singer of the Toronto chapter.

Visitors to Peterboro enjoyed plant tours arranged on November 16 and 17 through the Canadian General Electric Co. and the Western Clock Co., Ltd.

Membership Roster

Peterboro ASTE members, in addition to the officers, are: George S. Amey, Peter Astle, Orvel E. Braden, Arthur G. S. Choate, William Campbell Clegg, Milton N. Clysdale, Percy C. Cole, Charles J. Davidson, Hubert G. Dewar, Donald W. Douglas, Frank V. Fisher.

William F. Fisher, Charles F. Foster, Edward R. Freeman, Orris R. Garside, Kenneth D. Gash, Jack M. Graham, Ernest M. Gregson, Eric J. Groves, Hugh W. Heslip, George M. Hill, Kenneth W. Hotrum, Harry P. Hughes, William H. Jackson.

Albert L. Jeffries, Melville E. Johns, Otto C. Kallay, William J. Kennedy, Raymond S. Killen, James A. Knight, Charles E. Lasenby, Jack G. Legros, Ronald MacGee, Alexander MacGregor, William S. McKinlay, Thomas P. McMillan, John Menzies, Eric Mills, Jan P. Moes, Donald G. Moorby, John Myall, Ronald C. Naish, John S. Olaveson, Hubert G. Panter, Ronald Passey, John H. Paull.

Donald E. P. Perks, Phillip J. Perley, Arnold A. Pickles, Albert F. Pilley, Harold Pulley, David A. Quigley, Donald E. Raddon, Charles J. Rainey, Ronald F. Routly, Ralph S. Sanderson, Thomas Snowdon, Douglas G. Taylor.

John W. Thirnbeck, Donald G. Tripp, John C. Veenman, Gordon K. Wainwright, Lennox W. G. Warren, Alan Whitehead, Gerald W. Willis, James Wilson, Norman W. Wood, Jack M. Worrall.

Standing (from left) are: Len Hansler, Robert Dyer, Ken King, Seated: George W. Kennedy, Earle Wellman, Thomas J. Donovan, Jr., Gordon Page and Harry Whitehall.

Salt Lake City Education Chairman Designs Teaching Aid for Engineering Classes

An ASTE member of the faculty at Utah State Agricultural College has perfected a universal projection device to be used as a teaching aid in projection drawing.

He is Prof. G. Merrill Shaw, head of engineering drawing at the college and education committee of the Salt Lake City chapter.

The aluminum device, equipped with a plastic picture frame, is the first of its type that will illustrate all five major planes of orthographic projection.

The usual instrument is a glass projection box which shows horizontal, vertical and profile planes. Prof. Shaw's device will also illustrate auxiliary and oblique planes.

Satisfactory results have been obtained in basic engineering and mechanical drawing classes where the device has been used during the past year. Its greatest value lies in the study of geometric problems.

Prof. Shaw perfected the teaching aid to help in meeting the requirements for a master's degree in graduate work under Frederick Preator, head of the USAC tool engineering department.

Prof. G. Merrill Shaw

Carbide Group Meets With Worcester Chapter

Worcester, Mass.—ASTE members joined forces with the Society of Carbide Engineers for a dinner meeting at the Worcester Polytechnic Institute. More than 100 members and guests attended the program on "Carbide Machining of Steel."

Participating in the panel discussion were Robert Warfel, general tool foreman at Pratt & Whitney Aircraft Div. of United Aircraft Corp. and Francis O'Sullivan, carbide foreman of New Britain Machine Co. A. Sheldon Childs, vice chairman of the Carbide Society was the moderator.

A short ASTE business meeting, conducted by Chairman Ralph A. Baker, preceded the technical session.

Lengbridge Compares Metal Spinning, Drawing

Erie, Pa.—"Metal Spinning" was the technical topic of J. W. Lengbridge, project engineer for Aluminum Goods, Ltd., of Toronto, at Erie's ASTE meeting held November 6 at Gannon College.

All engineering phases of metal spinning were covered in Mr. Lengbridge's discussion. Particular emphasis was placed on the economic considerations of spinning as compared to drawing.

The program was illustrated with slides and a movie on special examples of metal spinning. A number of sample products manufactured by the Toronto firm were also exhibited.

Forty-two members and guests attended the meeting.

Model Relay System Shows TV Transmission

Peoria, Ill.—A miniature microwave radio relay system was exhibited for Peoria members at their November meeting to show how television programs and telephone messages are transmitted across the nation.

The display was a model of the relay system which is in use between New York and San Francisco.

The program, "Words Over Waves," was presented to 150 tool engineers at the Jefferson Hotel by B. C. Eustice, manager of the Peoria Division of the Illinois Bell Telephone Co.

A lively question and answer period concluded the session.

Wichita Members Visit A. O. Sutton Plant

Wichita, Kan.—The entire manufacturing sequence employed at the A. O. Sutton Corp. in Wichita was studied by a group of 80 ASTE members and guests at their regular meeting on November 14.

Visitors toured the modern drafting room, experimental department, machine tooling shop, power press room, aircraft production section, electrical and inspection departments.

The chief engineer of Scully-Jones & Co. in Chicago, Harry Conn, spoke to the chapter in October on production tooling problems. He stressed the importance of choosing the right tap for the job, selection of the proper coolant and the correct usage of thread formulae.

A delegation of professors and students from the University of Kansas attended the tool engineers' program, including Professors Warren Snyder, head of the mechanical engineering department; Kenneth Rose, head of mining and metallurgy; and Albert Palmerlee, head of engineering drawing.

Also present were Professors Paul Hausman, head of engineering shop practices; William Simpson, head of aeronautical engineering; and Arthur Paul of the mechanical engineering department.

Offers Refresher Course

Philadelphia, Pa.—The second semester of the refresher courses for professional engineers offered by the Evening College of Drexel Institute of Technology will open January 11 and 12. Classes will continue through the first week in June. K. W. Riddle, member of the Philadelphia ASTE chapter, is director of the Evening College.

Guiding this year's program and business for the Hartford, Conn., ASTE chapter are 11 members of the executive committee. In the front row (from the left) are: Edward T. Ross, secretary and education chairman; Henry Kuryla, first vice chairman; Robert Toppin, chapter chairman; William Allison, second vice chairman and Omer Gingras, treasurer. Standing: Herbert Richardson, Paul Dillberg, Harry Anderson, membership chairman; A. Douglas Proctor, public relations chairman; Richard A. Smith, past chairman and Henry Moore.

Honor President Demuth on West Coast

November 17 was National President's Day for over 300 members of four western ASTE chapters who attended a joint meeting at the Hollywood Roosevelt Hotel in Hollywood, Calif.

President J. J. Demuth, National Director Ben J. Hazewinkel, Chairman Dick R. Linch of the National Constitution and By-Laws Committee, John Stansbury of the National Membership Committee, and Executive Secretary Harry E. Conrad were honored guests at the special program.

A forum was held in the afternoon to discuss mutual aims and goals of chapter members from Salt Lake City, San Diego, Los Angeles and Long Beach. Chairmen and committee heads reviewed chapter organization, programming and membership activities with the Society's national representatives.

At the evening banquet held in the hotel's main ballroom, President Demuth gave an inspiring speech on the progress of ASTE.

Dr. Howard S. Siefert, staff engineer of the Jet Propulsion Laboratory, California Institute of Technology, spoke on "Rockets and Their Uses."

Radio and television entertainers closed the program with several outstanding performances.

Prof. Frederick Preator, head of the tool engineering dept. at Utah State Agricultural College, points out the location of the Salt Lake City chapter. With him are William Evans (left) and Ray Hogan.

President J. J. Demuth (left) and Dr. Howard S. Siefert, technical speaker, talk with Executive Secretary Harry E. Conrad before the banquet program gets under way.

Shown at the speakers' table at the discussion forum (from left) are: Dan Campbell; Ollie Smith; Ben J. Hazewinkel, national director; Dick R. Linch, chairman of the Constitution and By-Laws Committee; President J. J. Demuth; George J. Walkey, Los Angeles chapter chairman; Executive Secretary Harry E. Conrad; John Stansbury, member of the National Membership Committee; Anthony Manino, San Diego chapter chairman; Ralph Chrissie, Los Angeles first vice chairman.

Industrial Leadership Key to World Leadership

Washington, D. C. — "Leadership must be developed in industry if the United States is to carry out its responsibilities in maintaining its number one position in the world's community of nations," stated G. T. Willey at the Potomac chapter meeting.

The vice president in charge of manufacturing and general manager of the Glenn L. Martin Co. spoke November 1 to a gathering of 75 persons at the Annapolis Hotel.

Mr. Willey called for more understanding and coordinated cooperation at the executive and supervisory levels to create a greater feeling of unity among employees.

Among the guests present for the meeting were Woodrow W. Faw, immediate past chairman of the Central Pennsylvania chapter, and Capt. R. E. W. Harrison, USN.

Leon L. Crosby was awarded a copy of the *Tool Engineers Handbook* for his excellent work in obtaining 15 new members in the current campaign.

H. L. Stewart Reviews Uses for Hydraulics

Newark, N. J.—"Fluid Power in Action" was discussed before the Northern New Jersey ASTE chapter by H. L. Stewart, assistant sales manager of Logansport Machine Co., Inc., at the October meeting.

Mr. Stewart outlined the components, circuits and applications of air and hydraulics for industrial equipment. Slides, some in color, showed the uses of air and hydraulics for brewery and harvesting equipment.

400 Detroiters Visit Ternstedt Division

Detroit, Mich.—"Each model change at Ternstedt costs seven to nine million dollars for tools alone," stated H. M. Rissman, resident manager, at the tour of the General Motors division taken in November by 400 Detroit ASTE members. About 20 percent of these tools are made at Ternstedt, the balance coming from outside suppliers.

He emphasized the importance of thorough planning and careful design work in keeping production up and costs down.

The history of Ternstedt, dating back to 1917, was outlined by J. L. Conlon, plant manager. The company was incorporated with GM in 1926 and made a separate division in 1948. Ternstedt products include 200 classifications of parts. On the list are die castings, cushion springs and many types of plating and painting work.

Groups of 12 toured the plant, guided by a member of the firm's supervisory staff, who explained the varied operations of stamping, shaping and polishing of hundreds of trim parts for automobile bodies, door locks and other hardware.

Outstanding to most of the members was the painting method used. The paint is magnetized and drawn to the metal parts to give complete coverage and to prevent waste.

A roast beef dinner was served in the company cafeteria before the evening's program got under way.

On October 11 the ASTE meeting was held at the Rackham Building. The Rev. G. Paul Musselman, rector of Mariners' Church in Detroit, told of the great need today for true Americanism. His coffee talk was followed by an address on impact extrusion delivered by E. V. Crane, head of special engineering at the E. W. Bliss Co.

Among the participants at the Boston-Little Rhody meeting were, left to right: Edward M. Dowd, National Director Joseph Crosby, President Demuth, Harold Seekins, George Glidden, Ralph Robbins, chairman of the National Professional Engineering Committee, and Howard Gambrill, Jr.

Demuth Presents Scrolls to Affiliate Members

Boston, Mass.—National President J. J. Demuth presented eight membership scrolls to affiliated ASTE members at a joint meeting of Boston and Little Rhody chapters. More than 250 tool engineers attended the program held October 11 at New England Mutual Hall.

Recipients of the scrolls were: Edward M. Dowd, executive vice president of Lapoint Machine-Tool Co.; Thomas Walsh, plant manager for Avery & Saul Co.; Robert H. Moore, purchasing agent of J. W. Moore Machine Co.; Arthur Nichols, treasurer of W. H. Nichols Co.; W. A. Jones, president of Control Engineering Co.; J. J. Gambrill, Jr., vice president of Gillette Safety Razor Co.; John W. Geddes, chief engineer of H. K. Porter, Inc.; and the Scott-Williams Co.

Awards Scholarships

Boston Chairman Prescott Smith presented Northeastern University students Warren E. Benson, Jr., and Marcus Slobins with scholarship awards to help further their college education. Each received a check for $240.

Among the guests at the meeting were Dean Alexander of Northeastern University; J. P. Crosby, National Director of the Society; Matthew Grochmal, past chairman of the Little Rhody chapter; and Philip Peckham, Little Rhody treasurer.

Technical speaker for the evening was Edward Polidor, chief engineer of Universal Engineering & Colorplate Co., Inc. He spoke on "Optical Projection Methods."

An audience of 250 Boston members and guests saw the Westinghouse show, "Adventures in Research," presented November 8 by A. R. Dostal. The speaker was presented by Technical Chairman Frank Lester.

Congratulations are due four ASTE chapters which already have met the goal of a 20 percent increase in membership set by the National Membership Committee.

Chapters leading the "20,000 Members in the Society's 20th Year" campaign are: Potomac in Washington, D. C.; Wichita, Kan.; Tulsa, Okla. and Albuquerque, N. M.

Membership increases were made before November 1.

The November program of the Evansville chapter was planned and presented by (left to right) Monroe Ringis, program chairman; Robert Rodger, Chrysler Corp., technical speaker; J. Henry Ballman, Servel, Inc., coffee speaker; and Joe Halbig, entertainment chairman.

Tells How Chrysler Engine Was Developed

Evansville, Ind.—Robert Rodger of the Chrysler Corp. spoke to the Evansville chapter at the November 12 meeting on the development of Chrysler's new V-8 engine. ASTE members met at the Hadi Shrine Temple for a dinner before the program.

Mr. Rodger, assistant to the chief automotive engineer, said the high efficiency engine was made possible by the use of a hemi-spherical combustion chamber with overhead valves and centrally located spark plugs. His talk was illustrated with colored slides.

The 79 members and guests in the audience also heard a coffee talk delivered by J. Henry Ballman of the Servel, Inc., sales division. Mr. Ballman is past president of the Servel Toastmasters club.

Carbide Quiz Draws 350 in Philadelphia

Philadelphia, Pa.—A crowd of 350 persons turned out for the first carbide quiz night staged October 18 by the Carbide Group of the Philadelphia chapter at the Engineers' Club.

Members heard single-pointed carbide tools discussed by Eugene Kelly, assistant to the director of General Motors Research Laboratory; Rudy LaPierre, carbide engineer and consultant with the Ex-Cell-O Corp.; James Smith, assistant supervisor, Bethlehem Steel Corp.; and Robert M. Tirrell, assistant to the president, Curtis Wright Corp.

Moderator of the group was W. A. Williams, research engineer of the American Pulley Co.

Panel members answered questions on dry grinding, mechanically held tips, slash-milled or pocket-milled shanks, and inspection of tools. Discussion also covered superfinishing and diamond lapping versus simple silicon carbide grinding and many other aspects of carbide preparation and application.

Experts who participated in Philadelphia's carbide quiz night are shown with Chapter Chairman William Griffith, far left. They are: Eugene Kelly, W. A. Williams, Robert Tirrell, James Smith and Rudy LaPierre.

Greist Co. Officials Describe Operations

New Haven, Conn.—New manufacturing methods and plant modernization impressed New Haven tool engineers on their tour of the Greist Mfg. Co. More than 100 ASTE members enjoyed the plant visit and the social hour and dinner sponsored by the company.

The firm's chief engineer, R. W. Burgess, outlined the history of the company. Technical chairman of the chapter, he later moderated a general discussion period.

The methods employed in bringing a new product to the consumer were discussed by John Connors, chief design engineer. Speeches were also made by W. B. Frank and W. L. Dowling.

275 ASTE Members Hear Herman Goldberg

Milwaukee, Wis.—More than 275 members heard Herman Goldberg speak on "Drilling, Tapping and Threading Equipment" at one of Milwaukee's most outstanding technical sessions.

Mr. Goldberg, president of the Snow Machine Co. of Bellwood, Ill., spoke November 8 at a dinner meeting held at the Elks Club.

The intricacies of tapping and drilling free hand to close tolerances were emphasized in Mr. Goldberg's discussion. He also covered the progress made during the past five years in drilling, tapping and threading.

Machinery was exhibited to illustrate Mr. Goldberg's address.

Discusses Die Problems

Greensboro, N. C.—An informal technical program on piercing dies was featured at the Piedmont ASTE dinner-meeting in November. Speaker was L. O. Richard, district sales manager of the Richard Brothers Div. of the Allied Products Co.

New developments in the field were reviewed by Mr. Richard who also discussed solutions to some difficulties encountered in the use of such dies.

Promote D. V. Roland

David V. Roland, secretary of the Hamilton District chapter, has been appointed assistant superintendent of the Rolling Mills of Atlas Steels, Ltd., in Welland, Ont. Mr. Roland joined the firm as an assistant to the metallurgist in 1947 after he was graduated from the University of Toronto. For the last three years he has served as sales engineer in the Hamilton area.

Variety Program Holds Ladies' Night Spotlight

Cedar Rapids, Iowa—An enjoyable evening of entertainment was provided November 16 when members of the Cedar Rapids ASTE chapter held their annual Ladies' Night.

Dinner was served to 122 members, their wives and guests in the Crystal Ballroom of the Hotel Montrose. Music for the dinner hour was furnished by accordionist Jack Sedlacek.

John Stark, past chairman of the chapter, acted as master of ceremonies. Guests were welcomed by Chairman Wencil Popek. The program included songs by a barbershop quartet, dancing to the music of Al Spetrino and his orchestra, and a tumbling demonstration of NCAA champion Bruce Sidlinger.

ASTE members from the Nashville chapter are shown at the November meeting. Front row, left to right: Judd Wilkinson, Secretary W. A. Thornberry, J. T. Sharpe, Paul Goff, Past Chapter Chairman Fred D. Wright, Lee Severy, Harry Collins, John C. Stockard, W. M. Orrand, M. W. Preston, Horace T. Sprott. Back row: Treasurer August Dobert, L. J. Leach, Chairman A. Scobey Rogers, Frank McCord, Marvin Fox, Second Vice Chairman John Gipson, E. L. Graves, Paul Gaynor and Paul Stuff, speakers, Editorial Chairman J. E. Riordan and J. C. Creviston. **(See Nashville story on page 77.)**

Board of Directors' Election Set

Nominating Committee Names 17 Candidates for March Voting

A slate of 17 candidates for election to the 1952-53 Board of Directors has been chosen by the Society's Annual Nominating Committee. Voting will take place in Chicago when the House of Delegates convenes March 17, 1952, at the 20th Annual Meeting.

Chapter representatives, selected by ASTE members in February, will elect 10 men to serve on the governing body. As indicated in the Constitution, President J. J. Demuth automatically becomes the eleventh member of the new board on the date of his retirement.

The Nominating Committee's report will be circulated to all members at January meetings so they may indicate their choice of candidates.

The number of nominees chosen by the committee dropped when National Secretary W. A. Thomas announced that an increased business schedule forced him to have his name withdrawn.

Additional names will be added to the list if 20 or more senior members sign a petition for each candidate. All petitions must be received at National Headquarters by February 1, 1952.

ASTE members serving on the Nominating Committee are: R. B. Douglas, chairman, R. W. Bayless, A. J. Schmidt, A. M. Schmit and J. M. Speck.

CANDIDATES

Incumbent National Officers

L. B. BELLAMY—1st v. p. and incumbent director ASTE. Branch mgr., Detroit office of Sterling Grinding Wheel Div., Cleveland Quarries. Senior member since 1939. Actively served as chm. of various chapter committees. Past chm., Detroit chapter. Past chm., Data Sheet Sub-Com. Past chm., National Standards Com. Former member, National Editorial Com. National director for three terms. Member, National Standards Com. Long experience in tool engineering with leading automotive company. Member, Engineering Society of Detroit and ASTE representative on Vocation Guidance Com., ESD. Member, Michigan Society of Professional Engineers. Active in other technical, professional and civic organizations. Registered Professional Engineer.

ROGER F. WAINDLE—2nd v. p., ASTE. Partner, Cannon-Muskegon Div. and director of research, Nugent Sand Co., Inc., Muskegon, Mich. Senior member since 1945 and charter member, Fox River Valley chapter. Active in chapter affairs and past chapter chm. Former member, National Finance Com. and past national director (one term). Active in technical, industrial and military organizations. Holds B. S. degree in Mechanical Engineering. Registered Professional Engineer.

THOMAS J. DONOVAN, JR.—3rd v. p. and incumbent director ASTE. Owner, Donovan Co., Philadelphia, Pa. One of three organizers of Philadelphia chapter and has been active in chapter affairs since. Senior member since 1938. Past chm., Philadelphia chapter. Former member of the National Constitution and By-laws Com. Served as national director for five terms. Member of Philadelphia chapter, ASM. Life member of Army Ordnance Assoc. and the Franklin Institute. Wide industrial and executive experience covering a period of years. Active in the Tool & Die Assoc. and other technical groups.

H. G. McMILLEN—National treas., ASTE. Plant mgr., Philco Corp., Bedford, Ind. Senior member since 1939. Charter member and past chm., Evansville chapter. Active in chapter affairs. Wide executive experience in refrigeration industry. Member, American Society of Refrigeration Engineers. Past chm. of National Finance Com. (two terms). Holds B. S. degree in Mechanical Engineering. Registered Professional Engineer.

H. B. OSBORN, JR.—Asst. sec'y-treas. and incumbent director, ASTE. Technical director, Tocco Div., Ohio Crankshaft Co., Cleveland, Ohio. Senior member since 1943. Has served actively in numerous chapter capacities including the chairmanship. Past chm. National Public Relations Com. (two terms). Past chm., National Membership Com. (two terms). School Board president and elected in 1946 by Cleveland Chamber of Commerce as "Outstanding Young Man of the Year." National authority in field of induction heating. Pres. of Cleveland Technical Societies Council. Broad and varied experience in technical and executive positions. Holds B. S. degree, M. S. and Ph.D degrees in Chemical and Metallurgical Engineering. Registered Professional Engineer.

Directors Nominated for Re-election

HAROLD E. COLLINS—Chief production eng., Hughes Tool Co., Houston, Texas. Senior member since 1939. Charter member and past chm., Houston chapter. National director for five terms. Served in advisory capacity to Joint Industry Mobilization Group of the Machine Tool Industry. Member, Tool Com. of Army Ordnance Assoc. Industrial executive and tool engineer. Active in other technical societies.

JOSEPH P. CROSBY—Sales mgr. and v. p., Lapointe Machine Tool Co., Hudson, Mass. Senior member since

J. J. Demuth

L. B. Bellamy

Roger F. Waindle

T. J. Donovan, Jr.

H. G. McMillen

H. B. Osborn, Jr.

Harold E. Collins

Joseph P. Crosby

E. W. Ernst

George A. Goodwin

Ben J. Hazewinkel

W. B. McClellan

1941. Head of various chapter committees. Served as chapter chm. National director for two terms. Wide industrial experience; membership in other trade and professional groups. Active in local civic organizations. Registered Professional Engineer.

E. W. ERNST—Mgr., Machine Tool Equip. Planning, Major Appliance Dept., General Electric Co., Louisville, Ky. Senior member since 1938 and life member since April, 1950. Past chm. of Schenectady chapter and former chm. of National Standards Com. (three terms). Chm. of Tool Engineers Handbook Com. (seven terms). Incumbent chm., ASTE Book Com. Served two terms as national director. ASTE representative on various American Standards Assoc. committees. Active in other professional organizations and in civic affairs.

GEORGE A. GOODWIN — Chief process engr., The Master Electric Co., Dayton, Ohio. Senior member since 1938 and charter member of Dayton chapter. Served on many chapter committees and as vice chm. and chm. of the Dayton chapter. Past chm., National Finance Com. Served three terms as national treasurer and two terms as director. Has held various engineering and executive posts since 1910. Member, Advisory Council on Tool Engineering of Sinclair College. Also active in other technical and civic organizations.

BEN J. HAZEWINKEL—Pres., Daily Grinding, Inc., South Gate, Calif. Senior member since 1942. Instrumental in organization of Denver, Salt Lake City, Los Alamos and Albuquerque chapters. Served as Denver chm. and delegate, national director for two terms, and member of National Membership Com. Active in local civic organizations. Broad industrial background in tool engineering field.

W. B. McCLELLAN—Engr., Gairing Tool Co., Detroit, Mich. Specializing in adaptation of cutting tools to special machine tool equipment. Senior member since 1935. Served as chm. of several Detroit chapter committees, 1st vice chm., 2nd vice chm. and chm. of the chapter. Past vice chm. of National Program Com. Past chm., National Editorial Com. (two terms). Past national secy., (three terms). Served as national director for one term. Active in other technical societies.

Additional Nominees

WILLIS G. EHRHARDT—Managing partner, Ehrhardt Tool & Machine Co. of St. Louis, Mo. Senior member since 1938. Active in chapter affairs, culminating in chapter chairmanship. Former member of National Membership and Program Coms. Long experience in tool and die field. Incumbent chm. of National Public Relations Com. Past president of National Tool and Die Mfr.'s Association. Member, ASM. Active in civic and technical organizations. Registered Professional Engineer.

JAY N. EDMONDSON—Professor of Industrial Engineering, Production and Tool Engineering Area, Ohio State University, Columbus, Ohio. Senior member since 1941. Has served as 1st vice chm., 2nd vice chm. and chm. of the Columbus chapter. Incumbent chm., National Education Com. (three terms). Member of the ASTE Tool Engineering Research Fund Com. Holds B. S. degree in General Engineering, and Professional Degree as Mechanical Engineer. Active in other civic and technical organizations. Member Ohio Technical Foundation. Registered Professional Engineer.

ARTHUR D. LEWIS—Owner, Art Lewis Production Equipment Co., Glendale, Calif. Senior member since 1942. Has served actively in numerous chapter capacities culminating in chairmanship. Former member, National Program Com. Past National Director (two terms). Wide industrial and executive experience. Registered Professional Engineer.

GERALD A. ROGERS—Sales engineer, Rudel Machinery Co., Ltd., Montreal, Que., Can. Senior member since 1942. Chapter program com. chm., 1st vice chm. and chm. of Montreal chapter. Former member and past chm. of National Program Com. Present member and secretary of National Membership Com. Wide industrial experience.

FRED J. SCHMITT—Director of Sales, D. A. Stuart Oil Co., Chicago, Ill. Senior member since 1938. Active in numerous chapter capacities culminating in chairmanship of Chicago chapter. Past chm., National Program Com. and chm., House of Delegates, 1948. Past National Director (one term). Active in other technical and executive organizations. Holds B. S. degree in Chemical Engineering. Broad and varied experience in technical and executive positions.

JOHN L. WEBSTER—Master Mechanic, Eclipse-Pioneer Div. of Bendix Aviation Corp., Teterboro, New Jersey. Senior member since 1939. Actively served on various chapter committees. Chapter delegate (two terms) and past chm., Northern New Jersey chapter. Member, National Finance Com. Has held responsible positions in industry. Active in other technical organizations.

Willis G. Ehrhardt

Jay N. Edmondson

Arthur D. Lewis

Gerald A. Rogers

Fred J. Schmitt

John L. Webster

Dayton members heard William McKendrick (second from left) of Fisher Body and M. J. Steuer (third from left), Frigidaire Div. of General Motors Corp., speak at the November meeting. Chapter Chairman L. R. McAfee, far left, and Richard Blair are pictured with the technical speakers.

POSITIONS AVAILABLE

SALES AND SERVICE ENGINEER needed by drill manufacturer to cover Ohio, Illinois, Indiana and Wisconsin. Write Box 101, THE TOOL ENGINEER, stating age, experience and salary requirements.

DESIGN ENGINEERS—The Taylor-Winfield Corp., 1052 Mahoning Avenue, N. W., Warren, Ohio, a leading electric resistance welder and electronic control manufacturer, has five openings for design engineers in its mechanical engineering department. These are permanent positions, provided men selected prove they have the necessary skill and ability. Men with resistance welding design experience are preferred. However, recent mechanical engineering graduates will be given careful consideration.

The work is 100 percent board work, involving the design of electric resistance welder machines and component parts, such as jigs and fixtures used in conjunction with this type of equipment.

Experience or training in electro-mechanical machinery would be a definite asset in meeting job requirements.

Interested applicants should write the personnel department. State age, education, experience, salary expected and other pertinent data.

TOOL AND MACHINE DESIGNERS—One of Cincinnati's largest permanent design firms has openings in their own office for experienced machine, product and tool designers, and detailers.

Recent engineering graduates or students will also be given consideration. These are permanent positions with a substantial, stable leader in the field. We can offer top starting wages, modern working conditions, paid holidays, vacations, and other benefits. Our policies assure varied experience and unusual opportunities with a future.

New employees would be expected to settle on a permanent basis in Cincinnati. Please send resume to Cincinnati Designing, Inc., 37 W. Seventh St., Cincinnati 2, Ohio.

Richard Blair Leaves Dayton ASTE Chapter

Dayton, Ohio—The appreciation of each Dayton ASTE member was extended at the November 12 meeting to Richard Blair for his fine service to the chapter. The first vice chairman and head of the program committee is leaving Dayton to accept a new position.

The evening's technical program covered design and maintenance problems of large press dies.

William McKendrick, assistant director of the die engineering section at Fisher Body, pointed out that his firm uses full-sized drawings to simplify layout and die-making problems. Drawings are made on vertical drawing boards, layout work on horizontal boards. Models are made up of wood before the die making begins.

M. J. Steuer, assistant tool supervisor of the Frigidaire Div. of General Motors urged close cooperation between design engineers and maintenance officials to assure easier repair of dies.

A four-man panel representing local industries answered questions presented from the audience in a general discussion period.

Utah Council Hears Waindle Speak on Production Potential

"There isn't a country in the world that can touch the potential productivity of the North American continent," Roger F. Waindle, second vice president of ASTE, told the Utah Engineering Council at a meeting held November 16 in Salt Lake City.

"If we use our productivity wisely and effectively," he said, "it is the key to the betterment of the entire world."

Mr. Waindle served as chief of tank and automotive production with the Army Ordnance Corps in World War II and is now a partner in the Cannon-Muskegon Div. and research director of the Nugent Sand Co., Inc., Muskegon, Mich.

He pointed out that in the United States 94 percent of all productive effort is performed by machines and tooling and only six percent is supplied by man himself.

Comparing the servility of man to the machine in Russia with the American philosophy, Mr. Waindle said we use machines to create health, wealth, comfort and happiness—not to enslave our people. He urged careful guarding of the freedom and dignity of man enjoyed in America, two of the biggest incentives to high production.

Making of Saws Pictured

Galt, Ont.—A film illustrating the manufacture of saws was shown in November to the Grand River Valley ASTE chapter. The movie depicted operations at the Simonds Saw Co.

The technical program was completed with a panel of six members who discussed questions on a variety of subjects presented from the floor. A buffet luncheon was served at the end of the meeting.

Anniversary Meeting Marks Hartford's 15th Year

Hartford, Conn.—The meeting held November 5 by Hartford ASTE members marked the fifteenth anniversary of the chapter's founding.

Commemorating the event, the progress of ASTE was reviewed by the first chapter chairman and past president of the Society, Irwin F. Holland.

His coffee talk followed dinner at the City Club. Members later adjourned to the auditorium of the Gas Co. for the technical session.

Arthur F. Murray, works manager of the Electrolux Corp., spoke on "Holding Devices." Emphasizing the importance of accurate, quick-action methods for positioning work for low-cost production, he covered in detail various methods for drilling, reaming and milling.

The topic was further discussed November 12 by a panel headed by William T. Allison, technical activities chairman, who conducted the special meeting.

Participating in the program were Eugene W. Laistner, manufacturing engineer with the Electrolux Corp.; Harry J. Hauck, vice president and chief engineer of Goss & De Leeuw Machine Co.; Robert M. Toppin, production manager at Jacobs Mfg. Co.; Harry E. Sloan, Jr., vice president of Cushman Chuck Co. and Joseph Balciunas of the Skinner Chuck Co.

E. J. Seifreat (second from left), speaker at the Indianapolis meeting in November, talks with (from left) H. D. Hiatt, chapter historian; National Director H. L. Tigges and Chapter Chairman E. W. Hilkenbach.

NPA Consultant Speaks at Indianapolis Meeting

Indianapolis, Ind.—Delegations from the Marion Mfg. Div. of the Dana Corp. in Marion, Ind. and the Allis-Chalmers new plant at Terre Haute swelled the ranks of ASTE members at the November meeting of the Indianapolis chapter. Close to 175 persons met at the Athenaeum for the dinner and technical session.

The president of the Seifreat-Elstad Machinery Co. and consultant to the National Production Authority, E. J. Seifreat, was guest speaker. He spoke to the group on "Problems of Machine Tool Users and Builders."

Toastmaster for the program was H. L. Tigges, immediate past president of the Society and present member of the board of directors.

He was introduced by H. D. Hiatt, permanent historian of the chapter.

Foundry Representatives Give Nashville Program

Nashville, Tenn.—ASTE members of the Nashville chapter heard a program presented by representatives of the Ross-Meehan Foundries at the November meeting. The technical session followed a dinner served at the Andrew Jackson Hotel.

A movie was shown the group on "Meehanite Means Better Castings." Narrators were Paul Gaynor, sales engineer at Ross-Meehan, and Paul Stuff, chief metallurgist for the firm, who later conducted a question and answer period.

A business meeting was conducted by Chapter Chairman A. Scobey Rogers. Plans for succeeding programs were presented and discussed.

At the October meeting of the chapter, Charles Brown spoke on "Tool and Die Salvage." He is regional manager of the Eutectic Welding Alloys Corp.

Slides were shown and the speaker gave several demonstrations. His program was concluded with a discussion period.

Westinghouse Program Features Atomic Power

Springfield, Vt.—Highlights of a Westinghouse program presented in November for the Twin States chapter were a three-dimensional atom model, a miniature atom-smasher, a model atomic "pile," and a super-fidelity phonograph. More than 80 members attended the technical session at Springfield High School auditorium.

A. R. Dostal, the Westinghouse representative, directed the "Adventures in Research" show. With a stage full of interesting equipment, he showed examples of six forms of energy: mechanical, electrical, chemical, heat, light and nuclear.

Chairman Floyd McArthur presided at the business portion of the meeting held at the Trade Winds Cafe. New members were introduced to the chapter by Harold Noyes, chairman of the membership committee.

Executives Hear Freedom Forum Speaker

Kansas City, Mo.—Evils of socialism and communism were discussed November 7 in an address by Myron T. Robinson before 60 Kansas City members and guests at a meeting honoring company officials and executives.

Mr. Robinson, head of supervision development for all plants of Swift & Co., spoke on the topic, "This Is Our Problem." For the past two years, he has been a speaker on the "Freedom Forum" programs.

In his description of the forums, Mr. Robinson explained the work to help identify socialism and communism, make for better understanding of the American way of life and to preserve our democracy.

New York Members, Guests Enjoy Dance

New York, N.Y.—A strictly social program was enjoyed by members of the Greater New York chapter at their November 4 meeting. Families and friends were invited to attend a dinner and dance held at the Village Barn. Two dance bands furnished music. Other entertainment was provided by Louise and Harris. Burt Hilber acted as master of ceremonies.

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Engineering Manager Speaks in Hamilton

Hamilton, Ont.—A. A. Moline, manager of the engineering dept. of the Canadian Westinghouse Co., was guest speaker at the November meeting of the Hamilton District chapter.

"The Mechanical Design of Waterwheel Generators" was his topic. Using a model of the Kingsbury bearing for illustration, he dealt with the problems involved in supporting the huge rotating parts.

Chairman John Yorick presented membership pins to four new members including the second lady member of the chapter, Miss Janet Hyndman.

Philadelphia Chairman William Griffith (center) congratulates Mayor John J. Davis of Reading, Pa., on his address at the chapter's Executive Night. Capt. F. L. Albert, USN, was the coffee speaker at the meeting attended by 350 members and guests.

Shows High Speed Movie Photography

Racine, Wis.—J. H. Niemeyer, technical representative of the Eastman Kodak Co., presented a program on high speed photography to ASTE members in Racine at their meeting November 5.

He spoke on "Magnifying Time—A Function of Photography," supplementing his discussion with a movie filmed at 1,000-3,000 frames per second. The film showed how a coolant flows on a cutting tool, how beads of metal are deposited in welding, the deflection of shaft stress at high speeds and other operations difficult to photograph at ordinary speeds.

The Massey-Harris chorus, directed by Gilbert Hansen, provided musical entertainment.

Tour Ford Plant

Monroe, Mich.—A turkey dinner and a plant tour highlighted the October meeting of the Waterloo chapter. Close to 200 members visited the Monroe plant of the Ford Motor Co. where knee action springs and stampings and castings for headlights are manufactured. The dinner was served at the plant.

West Coast News

By Andrew E. Rylander

Two recent ASTE meetings—the regional meeting November 17 in Los Angeles and an executive meeting of the Golden Gate chapter November 21—have promise of giving considerable impetus to tool engineering activities on the West Coast; for that matter, to the entire Southwest as well as the mountain area.

The first, attended by President J. J. Demuth, Executive Secretary Harry Conrad, and representatives of other west coast and mountain area chapters, had all the earmarks of an ASTE convention. Among those present was Prof. Frederick Preator, head of the Tool Engineering Dept., Utah State Agricultural College, who has been largely instrumental in initiating a tool engineering course, with degree on graduation, at Utah State. Thus, he has driven in the entering wedge toward similar courses, with degree, in other colleges.

President Demuth's address was highly inspiring, so much so that in addition to having proven himself an outstanding leader in the Society, he may also be considered as one of its most enthusiastic salesmen. The meeting, impressive on the whole, was rounded out by a talk on rockets and their uses by Howard S. Siefert, staff engineer at the Jet Propulsion Laboratory, California Institute of Technology.

Speaking for myself, I rode down to L. A. with Art Lewis, leaving immediately at the end of the meeting of Golden Gate chapter November 14, where John A. Harrington of DoAll Co., guest speaker, had given a talk on quality control. Arriving early as a result, I had opportunity to visit the Lockheed Aircraft Corp. in Burbank where through the courtesy of David Laughlin, I was enabled to see their huge airfoil miller—housed in the Lockheed "Hall of Giants"—put through its paces. Dave, who is not only highly versatile but a highly trained engineer with more than average inventive ability, is a "natural" for membership in ASTE. I hereby extend him a most cordial invitation to enter the fold.

While Harry Conrad and myself were sunning ourselves along the pool at the Hollywood Roosevelt, we got acquainted with a young gunsmith by the name of Armand Swenson, who later visited me on my return to Walnut Creek. He, too, seems to have all the necessary qualifications for membership and is therefore included in the invitation. For that matter, there are vast membership potentials along the Coast.

The San Francisco meeting November 21, at which Harry Conrad presided as host, was attended by the entire executive board of the Golden Gate chapter. Problems, peculiar to this area, were discussed and satisfactorily resolved by Mr. Conrad, who further brought out the advantages to be gained by splitting Golden Gate chapter with a view toward a wider coverage of tool engineering activities.

Expressing my own opinion, the idea has considerable merit, especially so in view of the long distances which must be traveled if the Bay Area is to be adequately covered. We can here cite various Canadian chapters as examples. For instance, members of Hamilton's chapter often had to travel 50 miles or more to attend meetings. Splitting this chapter in nowise depreciated membership. On the contrary, total membership increased as a result. The same may be said for other chapters which gained through a split.

In this connection, a split does not mean a division within the Society. Rather it adds members to the family and in the long run promotes attendance. Among other things, it gives a member an opportunity to attend a meeting of a chapter featuring subject matter suited to his needs and further provides opportunity for joint meetings such as have been found so conducive to good fellowship in the eastern Michigan area. The idea should therefore be given matured consideration.

One thing about California, everything is unusual, including the usual. The weather especially. On December 1 f'instance, the Bay Area suffered the worst storm in its history when winds, soaring up to 110 mph, caused such swaying of the Golden Gate bridge that it had to be closed to traffic. And did it rain! Had that water been converted to snow we'd have had to tunnel our way through drifts.

To the end that the science of tool engineering be duly impressed on the Bay Area, Golden Gate chapter is sponsoring in cooperation with Oakland Public Schools a rather comprehensive course in the "Fundamentals of Tool Engineering." Sparkplugs for the course, which is designed to provide a basic knowledge of tool engineering with an appropriate certificate from ASTE, are Henry De Coursey and Vernon Gallichotte of the Golden Gate educational committee.

And that will be all until I see you next month.

Arthur Green Gets Elmira Service Award

Elmira, N. Y.—The outstanding service pin of Elmira's ASTE chapter was awarded in November to Membership Chairman Arthur Green. Largely through his efforts, names of 17 tool engineers were added to the roster in the period between September and November.

Henry LeMaire, chapter chairman, made the presentation before 75 members and guests.

The technical portion of the program was handled by W. C. Wall, development engineer with the E. I. du Pont de Nemours and Co., Inc. In his talk on "Plastics Versus Metals," Mr. Wall compared the mechanical behavior of nylon as a machine component with that of other plastics and metals. Practical applications were on display for the members.

In October, 67 Elmira members and guests attended a dinner meeting and enjoyed an entertaining program presented by Joseph L. Andrews.

Century Electric Co. Toured by 300 Members

St. Louis, Mo.—Stamping dies, fixtures, cutting tools, electronic gages and special purpose machines were displayed at the Century Electric Co. for 300 St. Louis ASTE members when they toured the plant in November.

The chapter was broken down into small groups of a dozen members. Special guides took them to various departments where supervisors were stationed to answer questions.

Most of the operations required to manufacture and test fractional horsepower and large motors were studied by the visitors. Movies were shown to illustrate the more detailed processes.

Before the tour began, 200 tool engineers were guests of the company at a dinner served at the Claridge Hotel.

Tool Salvage Covered at Joint ASM, ASTE Meeting

Rochester, N. Y.—A joint meeting of the Rochester ASTE chapter and the American Society for Metals was held November 5 at the Barnard Exempt Club.

Featured speaker was the regional manager and welding consultant for the Eutectic Welding Alloys Corp., L. D. Richardson, who spoke on tool and die salvage.

With shortages of critical materials mounting daily, salvage of tools and dies is assuming new significance. Mr. Richardson covered the electric and acetylene welding of tools, jigs, dies and cutters and gave solutions to the problems encountered in the repair of such equipment.

Coming MEETINGS

CHICAGO—March 17-21, American Society of Tool Engineers' Industrial Exposition and 20th Annual meeting.

BALTIMORE—January 8, program on "Marform" presented by a representative of Loewy Construction Co., Inc., New York City.

CLEVELAND—January 11, plant tour, Yoder Co.

DETROIT—January 10, Rackham Building, Father and Son Night. January 3, Rackham Building, Carbide Section. Subject: "Single Point Tooling."

ERIE—January 8. Speaker: K. J. Yonkers, Allis Chalmers Mfg. Co., Milwaukee, Wis. Subject: "Precision Investment Castings."

MID-HUDSON—January 8. Speaker: W. R. Buerckel, technical lecturer, Nicholson File Co., Providence, R. I. Subject: "Manufacture, Metallurgy and Application of Files."

GRAND RIVER VALLEY—January 4. Speaker: E. J. Klonowski, Pivot Punch & Die Corp., North Tonawanda, N. Y. Subject: "Pivot Punches, Their Use and Application." February 1. Speaker: H. L. Murch, chief optical engineer, Jones and Lamson Machine Co., Springfield, Vt. Subject: "Modern Methods of Inspection by Optical Projection."

GREATER LANCASTER—January 15, Stevens Trade School. Speaker: C. R. Schmitt, manager, lubricating sales dept., E. F. Houghton & Co., Philadelphia, Pa. Subject: "Industrial Lubricants."

HAMILTON DISTRICT—January 11, Father and Son Night.

LEHIGH VALLEY—January 18. Speaker: Robert H. Krepps, Denison Engineering Co., Columbus, Ohio. Subject: "Production With Hydraulic Power."

MADISON—January 8. Speaker: W. L. Bukovich, process engineer, Wadhams Div., Socony Vacuum Oil Co.

MOHAWK VALLEY—January 22. Speaker: Walter H. Kraemer, Butler Mfg. Co., Syracuse, N. Y. Subject: "Steel-Aluminum Buildings."

MUNCIE—February 5. Subject: "Gaging for Profit," presented by a representative of Federal Products Corp., Providence, R. I.

NEW HAVEN—January 10. Speaker: A. C. Sanford, Federal Products Corp., Providence, R. I. Subject: "Automatic Gaging."

NEW YORK—February 4. Speaker: G. R. Brown, field metallurgist, Haynes Stellite Co., New York City. Subject: "The Precision Investment and Casting Process."

PIEDMONT—January 14, Hotel Robert E. Lee, Winston-Salem. Program on "Gaging for Profit" by a representative of Federal Products Corp., Providence, R. I.

ROCHESTER—January 7. Speaker: K. N. Macomber, Lapointe Machine Tool Co., Hudson, Mass. Subject: "Latest Developments in Surface Broaching."

SEATTLE—January 22. Speaker: E. L. Tollefsen, Boeing Airplane Co. Subject: "Spinning of Metals."

SPRINGFIELD (ILL.)—January 8. Speaker: Dr. Harry B. Osborn, Jr., technical director, Tocco Div., Ohio Crankshaft Co., Cleveland, Ohio. Subject: "Induction Heating."

TOLEDO—January 9. Speaker: N. M. Perris, senior associate, Stevenson, Jordan and Harrison, Inc., New York City. Subject: "Management Engineering Problems."

TULSA—January 10. Speaker: Warren D. Getchell, McCrosky Tool Corp., Meadville, Pa. Subject: "Use of Inserted Blade Tools."

TWIN STATES—January 9. Speakers: M. F. Judkins, Firth Sterling Steel & Carbide Corp., Pittsburgh, Pa., and Stanley W. Lovejoy, General Electric Co., West Lynn, Mass. Subject: Carbide Symposium.

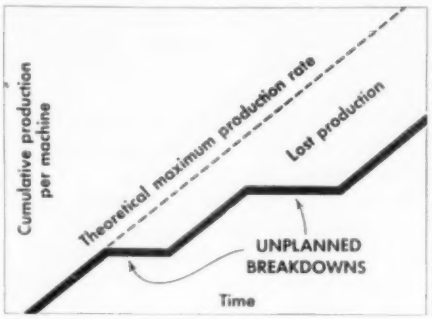
WORCESTER—January 8. Speaker: Glen H. Stimson, Greenfield Tap & Die Corp., Greenfield, Mass. Drill and Tap Night.

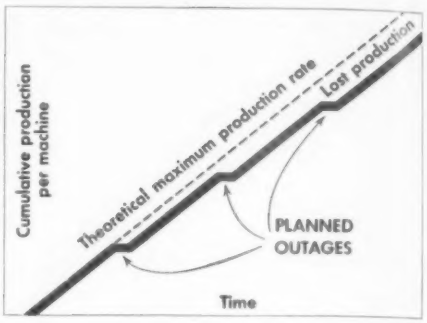
Pictured at the Rochester meeting held in November (from left) are: James Horne, ASTE chairman; L. D. Richardson, technical speaker; Donald Kohler, ASTE second vice chairman; and Robert J. Barr, ASM chairman.

News in Metalworking . . .

PRODUCTIVE MAINTENANCE HELPS IN INDUSTRIAL MOBILIZATION

Aimed at helping maintenance engineers in setting up a program to minimize lost production time and forced idleness due to equipment failures, the General Electric Co. has organized a plan called "Productive Maintenance", designed to place this function in the field of production as an operational asset, instead of allowing it to remain in the field of costly trouble shooting.





The plan recommends (1) an adequate staff of trained maintenance men, (2) the tools they need to perform properly the functions of (3) regular, routine checks of operating equipment, and (4) planned outage of this equipment at regular, scheduled intervals. (5) In addition, an adequate stock of mechanical and electrical renewal parts for rebuilding and modernizing machines during times of planned outage. During these periods of scheduled interruption, maintenance men can keep equipment performing as it was designed to perform. The program thus becomes productive maintenance, capable of creating added output without additional machines. In this way, maintenance anticipates the problems of unwanted production breakdowns and acts to minimize the probability of their happening. In addition the outages may be planned in advance for the time when the machines can be taken out of service for the shortest possible time and the stoppage will least affect total output and other operating units in the plant.

By substituting planned shutdowns, a thorough time- and production-saving repair job may be carried out before the equipment reaches the point where it might break down of its own accord.

To do this effectively, a complete, systematic survey should be conducted first covering the plant, how it operates, the equipment, and the role of each machine in relation to the others. Thus the survey analyzes the entire operation of the plant—determines which equipment is the most critical, which carries the heaviest loads, notes condition of each and its vulnerability, age, state of repair, severity of duty and similar factors that will enter into determining the desirability of additional repair and the kind of maintenance required. On this basis, recommendations can be made for a sound, over-all planned-outage program, and the means can be

Rectangular . .
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Walker Magnetic Chucks are designed for three absolute essentials . . . Polarization, Saturation and Balance. That is why Walker Chucks hold firmly at all points. Over sixty years' broad experience in chuck design and manufacture is behind every Walker Chuck.
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devised for handling it with a minimum of interruptions to the normal production schedule.

Recognizing the importance of increased production throughout industry, General Electric is providing maintenance men with a file-size kit consisting of an instruction bulletin, balance sheet for keeping data, and check lists for equipment to aid them in carrying out their own maintenance program.

MANUFACTURERS REVIEW SKILLED-WORKER PROBLEMS

A shortage of skilled labor amounting to 5,000 skilled workers in contract shops alone at a time when the industry is facing the biggest backlog of orders in its history—as much as 90 percent in some areas—were among the informal statistics presented to the National Tool and Die Manufacturers Association by its executive secretary, George S. Eaton, at the Association's recent annual meeting.

According to a business and labor conditions survey, practically every tool and die shop needs more manpower. This figure becomes more significant when it is pointed out that there are approximately 45,000 men in the entire country who qualify for work in this field, and that these are now employed, leaving no "pool" available.

Solutions advanced to meet this problem included possible training programs to build a talent pool. At the same time industry has requested Selective Service to view such training in the same light as it now views college training. NTDMA executives emphasized the fact that it takes from four to seven years to train men for this type of work, and that interruptions in training are uneconomic as well as dangerous in the sense that they tend to result in slow down of the vital "tooling-up" process required in defense industries during emergency.

ACME STEEL OPENS DIVISION

Formation and organization of Acme Steel Products Division, effective January 1, 1952, has been announced by the Acme Steel Company. The division will operate as an independent sales and distributing company for Acme's products and equipment which previously were sold through the company's internal Consumer Products Division. Sales of strip steel and special products will remain with the parent company as will all manufacturing and production operations.

John G. Bucuss, former general manager of the strapping division, will be president of the new division. Mr. Bucuss, who has been with Acme for 33 years, is currently president of the Materials Handling Institute.

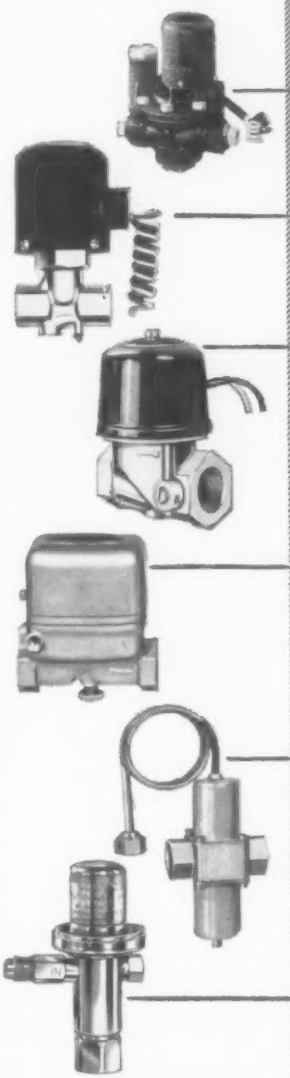
(Continued on page 82)

WHEN YOU NEED DEPENDABLE CONTROL VALVES

. . . SPECIFY A-P

Whether you need solenoid valves to control air-operated fixtures or whether you must control the flow of gas, liquids or refrigerants in processing parts, it will pay you to investigate A-P control valves.

A-P offers a wide variety of valves adaptable to temperature, pressure or electric control. Years of experience, unexcelled engineering and production facilities, close quality control and meticulous testing guarantee unusual dependability of operation and performance.



REMOTE CONTROL
SOLENOID VALVES

Heavy-duty, pilot-operated, industrial-type solenoid valves for water. Non-overheating moisture-proof coil, easily removable strainer and valve seat. Capacity to 3000 gal. per hr.

Multi-purpose solenoid valve. Handles air, water, or non-corrosive liquids and gases. Capacity up to 600 gal. per hr.

Rugged, long-life solenoid valve for low pressure air or gas control. Positive opening and seal-off, even with voltage or pressure variations. No sticking or gumming. Quiet, no-hum operation due to unique design.

SILENT, POSITIVE-OPERATION
THERMO-ELECTRIC GAS VALVES

Where inexpensive, reliable automatic temperature control is required, this thermo-electric gas valve has many advantages. Its diaphragm-operated power element is absolutely silent in operation. Positive, tight seal-off; full opening, full closing on 30-second cycle. Large capacity; compact size; dependable functioning.

PRESSURE-REGULATED
WATER VALVES

A-P water valves will control water flow in response to pressure changes. Unique valve design permits trouble-free operation even in very dirty water. Operating pressure adjustable from 65 to 300 p.s.i. Maximum water pressure 150 p.s.i. 3/8", 1/2", and 3/4" sizes; capacities from 3 to 42 gal. per min.

PRESSURE OR TEMPERATURE CONTROLLED
EXPANSION OR THROTTLING VALVES

Designed primarily for refrigerant control, A-P expansion valves are adaptable to many applications where automatic control of temperatures or pressures is required. If you have a problem involving the control of liquid or gas flow in response to pressure or temperature changes, a standard, low-cost A-P expansion valve may provide an immediate answer.

A-P DEPENDABLE Controls

For Air • Liquids • Gases • Refrigerants

A-P CONTROLS CORPORATION

(formerly Automatic Products Company)

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HEAVY DUTY MILLING MACHINES

plain, universal, horizontal and vertical

MODEL SE 20 (Plain)

Sizes	Mammut Models	H.P.
1	0	4
2	10	5½
3	20	12-15
4	20H	22
5	30	25
6	40	28

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UPRIGHT & RADIAL DRILLING MACHINES
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COLD SAWS

KLINGELHOFER MACHINE TOOL CO.

20 Prospect Street — Westfield, N. J.

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(Continued from page 81)

DRIVE SAVES 500 TONS NON-PRODUCTION SCRAP

Non-production scrap metal with a weight equivalent to 107,012 bazookas or 13,376 fifty-calibre heavy machine guns has been salvaged this past year by The Yale & Towne Manufacturing Company. The scrap, more than 1,000,000 pounds of it, in addition to the usual "process scrap", was the result of a concentrated program initiated in cooperation with the National Production Authority's recent request for a national drive.

The non-production metal scrap recovered by Yale & Towne consisted mainly of worn-out or obsolete tools, dies, jigs, fixtures, machinery, sinks, metal partitions and cast iron pipes.

TOCCO LAUNCHES CONTEST

Tocco Division of The Ohio Crankshaft Company has announced plans for its second "Economy in Production" contest. A $1,000 purse tops the ten prizes offered for the best of descriptive articles dealing with increasing production and/or decreasing cost with the company's product, and must describe actual installations of its induction heating equipment. Closing date for the competition is June 1.

CHASE BRASS AND COPPER PASSES DIAMOND YEAR

Chase Brass and Copper Company, Inc. has marked its 75th year in the industrial world. Established in 1876 as the Waterbury Manufacturing Company, the organization, launched with a capital of the then considerable sum of $25,000, was consistently expanded and improved until today Chase is recognized as one of the country's largest brass mills.

Growth included the building of the Chase Rolling Mill Company and the Chase Metal Works, Inc., which were finally merged, along with the original firm, into the Chase Companies, Inc.

BENCHMASTER BUILDS

Announcement from Benchmaster Manufacturing Company has revealed construction of a new plant in Gardena, Calif., one of the industrial areas near Los Angeles. This is the first unit of an eventual five-acre development, which, when completed, will represent a three-quarter of a million dollars investment.

OPEN ENGINEERING OFFICE

Henry D. Fowlie and his associates recently opened Sheffield Engineering Co., 502 S Main St. and at 1216 Catalpa Dr., Royal Oak, Mich. The profit-sharing firm, headed by Mr. Fowlie, is made up principally of professional engineers experienced in tool and machine design.

The firm was erroneously reported in the December issue as Henry D. Fowlie & Associates.

Tools of Today . . . .

Screw Machine

Designed to cover the field of the former wire feed screw machines, the hand screw machines, announced by Brown and Sharpe Manufacturing Co., have many new features, particularly the spindle with its wide range of speeds and ratios.

The full-antifriction-bearing spindle has positive chain drive at all speeds and a completely enclosed drive similar to Brown & Sharpe automatics. Many two-speed combinations are provided with ratios of high to low speeds from 1.6:1 to 13:1. Speed changes are made by simple pick-off gears.

The quick-operating one lever spindle control and mushroom-top trip lever for automatic chuck and bar feed are of similar design to those on the corresponding wire feed machines and the cross slide and turret have the same features.

Automatic oiling is provided for all major mechanisms and bearing surfaces throughout the machines.

Feed tubes, feeding fingers, collets and many tools from the automatics can be used in the hand screw machines thereby reducing toolroom inventory.

T-1-831

Drum Handler

A horizontal drum handling device that can be attached to any industrial fork truck without removing the forks

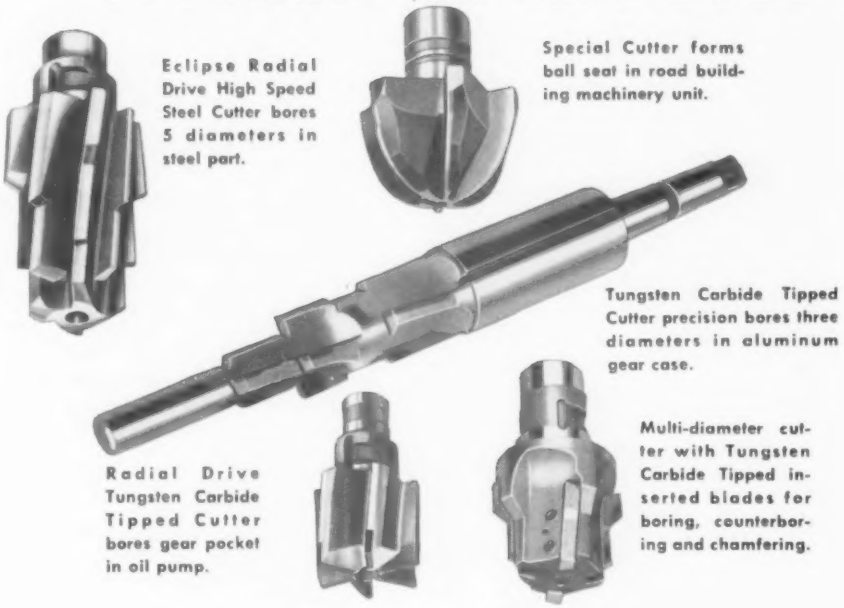
or making any hydraulic or mechanical connections is now available from the Philadelphia Division, Yale & Towne Manufacturing Co. Completely automatic, the new device is a self-contained unit that fits over the forks and is fixed to them with two screw-type clamps.

One or two standard drums can be picked up with the Yale drum handler by simply lowering it over them while the truck is slowly backing away. The rear clamps are spring loaded and snap under the lip of the drum. When the drums are lifted, gravity action locks the clamping hooks in place. There is no load on the springs at any time. Depositing the drums is just as easy as picking them up. The drums are lowered, the truck is moved forward (stretching the springs on rear clamps) and as soon as the forward clamps are free, the channels on the truck are tilted back. The truck is then backed away to free rear clamps. **T-1-832**

In Defense or Peace

ECLIPSE Specials

. . . . ARE THE BEST BUY!



Eclipse Radial Drive High Speed Steel Cutter bores 5 diameters in steel part.

Special Cutter forms ball seat in road building machinery unit.

Tungsten Carbide Tipped Cutter precision bores three diameters in aluminum gear case.

Radial Drive Tungsten Carbide Tipped Cutter bores gear pocket in oil pump.

Multi-diameter cutter with Tungsten Carbide Tipped inserted blades for boring, counterboring and chamfering.

Since 1913—through two wars and during the peace years—Eclipse has met the exacting and changing demands of industry for special purpose end cutting tools. What better test? What better recommendation? Our large modern plant can serve you, too. Send your problem to us, today!

ECLIPSE COUNTERBORE CO.

Founded in 1913

DETROIT 20, MICHIGAN

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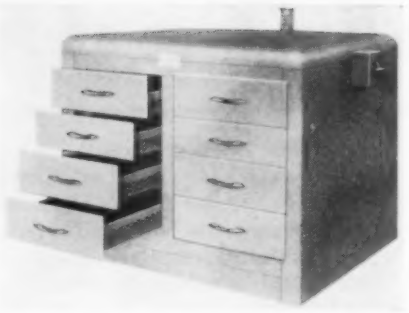
Portable Oven

The latest oven added to the Grieve-Hendry line of portable electric ovens has 8 drawers that permit baking of different materials at the same time or materials inserted at intervals. High temperature magnesium strip heaters provide efficient heating.

Its light weight of 118 lb. makes it easy to move. Temperature control is by thermostat and is adjustable up to 325 deg F. It plugs into a 110-volt outlet. Forced circulation is by fan driven by electric motor. An adjustable damper controls volume of air circulation.



Stale air is forced out through specially located exhaust ports.

Another feature of the oven is that these ovens can be used in a group or battery or stacked one on top of the other. All can be operated at the same temperature or with certain ovens cut out.

Outside dimensions are 30 x 25 x 24 in.

For information write to Grieve-Hendry Co., Inc., 1101 North Paulina St., Chicago 22, Ill. **T-1-841**

Gage Lubrication

A new lubricant, for precision gages and other close tolerance surfaces, is claimed by the manufacturer to extend the use-life of such instruments by 500 to 1000 percent. This is a new formulation of the original Micronoil Gage-Lube.

The most important advantages claimed from the use of Micronoil Gage-Lube are longer age life, no dimensional change, easier and faster inspection, with greater accuracy, and is an excellent tapping and lapping lubricant.

Write Protective Coatings, Inc., Detroit 27, Mich. for additional information. **T-1-842**

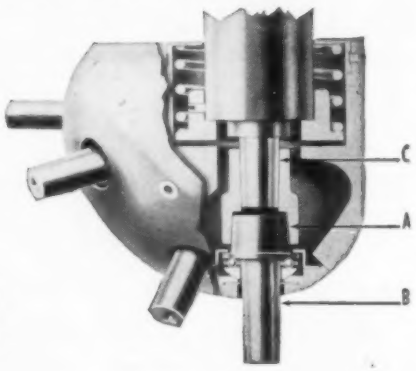
Drawing Board

A portable drawing board molded from light weight Bakelite styrene plastic incorporates a number of features which are of interest. The drawing board consists of a single molded piece of clear plastic, $9\frac{3}{4} \times 12\frac{1}{4}$ in. Four corner clamps for attaching $8\frac{1}{2} \times 11$ paper make it no longer necessary to carry

thumb tacks. The clamps are recessed into the plastic so that the triangle or roller can ride freely over them without interference. Two metal straight edges, one vertical and one horizontal, are retractable so that the triangles can be moved over all four edges of the paper. The use of light weight plastic has reduced the weight of the drawing board by 75 percent over conventional boards. Thirty, sixty and forty-five degree triangles can be stored in recesses underneath the drawing board and can be clamped securely in place. Made by A. Partrick Company, 9 Grove St., Westwood, N. J. **T-1-843**

MORE HOLES
PER HOUR — PER DOLLAR

Increase production of any standard drilling machine by adding a Lign-o-matic, the *only* drill turret with the patented, self-centering principle that guarantees sustained accuracy equal to the drilling machine itself.



FOR ALL CONSECUTIVE DRILL PRESS OPERATIONS

PROVED PRODUCTION INCREASE — Turret indexes faster than tools can be changed or work moved to another spindle. A single Lign-o-matic will release 5 drilling machines for other work and still show increased production and reduced costs on original job.

VERSATILITY — Fits any standard drilling machine without altering the machine. Handles operations such as drilling, reaming, counterboring, and tapping (on reversible spindle machines), up to ½" diameter in any material.

PRECISION — Patented, self-centering tapered drive (A) automatically locks turret spindle (B) into exact alignment with drilling machine spindle (C) for sustained accuracy.

GUARANTEE — May be returned in 10 days *for any reason* for full refund of purchase price. Two-year guarantee against defective parts.

PRICE — Model D, 6 spindles with No. 2 Jacobs male taper $235.00
Chucks extra at established prices.

DELIVERY — Currently, 2 weeks.

☐ Please rush ..... Lign-o-matic turrets for
(drill press make)..... (size).....
(quill dia.)..... (spindle taper).....
My name.....
Title .....
☐ Please send literature on Lign-o-matic turret.
(Attach coupon to company letterhead)

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ENGINEERS

TO DESIGN, REDESIGN, OR DEVELOP YOUR PRODUCT

ENGINEERS

TO TOOL AND EQUIP YOUR PLANT FOR THE BEST PRODUCTION ECONOMICS

ENGINEERS

TO GET YOUR NEW PRODUCTION GOING AND KEEP IT GOING

ENGINEERS

TO REDUCE YOUR COSTS AND IMPROVE YOUR QUALITY

PIONEER ENGINEERING

& MANUFACTURING CO., INC.

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ENGINEERS, DESIGNERS, CONSULTANTS AND PRODUCTION SPECIALISTS

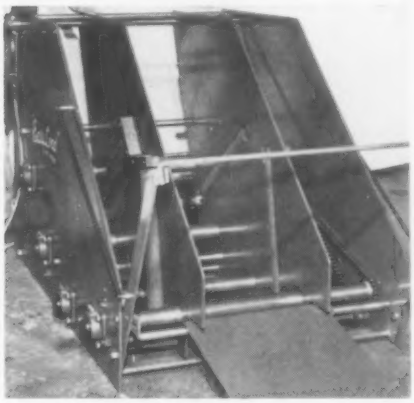
19645 JOHN R STREET
DETROIT 3, MICHIGAN

INQUIRIES PROMPTLY ANSWERED

INDICATE A-1-85-1

Stock Cradle

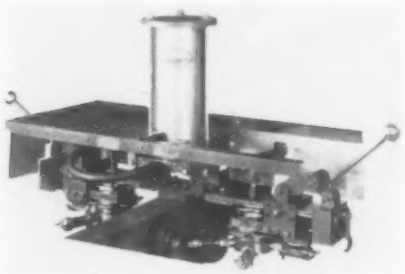
Rowe Machinery & Manufacturing Co., Dallas, Texas, announce the addition of Series 3,000 to their standard line of Easy-Load motor-driven, automatic coil stock cradles. Previously the 3,000-lb capacity cradle has been produced only on special order.



The 3,000 Series Easy Load takes stock with a maximum OD of 48 in. and maximum width of 15 in. as standard. Additional widths may be had on quotation when within weight capacity of cradle. A newly designed actuating arm operates on the inside or outside of the slack loop. Hardened and ground rolls are mounted in each of the two individually controlled guide plates. The reversing switch is standard equipment. **T-1-851**

Conveyor Lubricator

An automatic conveyor lubricator with enclosure especially designed for foundries or any other operation where an unusual amount of dirt, dust, spray, etc. circulates, is announced by the J. N. Fauver Company, Inc., 49 West Hancock, Detroit 1, Mich. This is a



self-contained grease lubricator type, driven by contact with the trolley wheels. As the trolley wheel approaches the lubricator, the hub engages the sleeve of one of the five pumping units. Continued rotation of the lubricator forces the pumping unit inward, delivering a measured quantity of lubricant to the wheel bearing. Then a cam located in the pump housing snaps the next pumping unit into position. **T-1-852**

PUMPS

FOR COOLANTS, LUBRICANTS, AND ABRASIVE LIQUIDS

PUMPS

POSITIVE DISPLACEMENT AND IMPELLER TYPES

PUMPS

J. I. C. STANDARDS OR DIRECT MOTOR CONNECTED

PUMPS

FOR TWENTY YEARS—DEPENDABLE, ECONOMICAL, EFFICIENT

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PIONEER PUMP

& MANUFACTURING CO., INC.

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STANDARD OR SPECIAL, FOR EVERY MACHINE TOOL AND INDUSTRIAL USE

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WRITE FOR CATALOG

INDICATE A-1-85-2

MAXITE
(W 14.00% —
V 2.15%—Co 4.75%)

VANITE
(W 18.00% —
V 2.15%)

STAR
High Speed
PERFORMERS

CLARITE
(W 18.00% —
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MOLITE
(W 6.50% —
Mo 5.00%—V 1.90%)

There are Columbia warehouses and highly trained Columbia representatives in principal cities. For service, for quality, look to Columbia — producers of fine tool steel by the electric process.

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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-86

Thin Film Step Gage

An instrument for accurately measuring the thickness of thin films by means of color comparisons, has been announced by the Special Products Division of the General Electric Company.

Called a step gage, the new device consists of a specially prepared glass plate enclosed in a plastic case. A film of barium stearate is deposited on the glass in a series of monomolecular layers, each layer having a thickness of 0.1 microinch. The successive layers are deposited in such a way as to build a series of steps made up of ten layers. Each step is one microinch thicker than the preceding one.

When the step gage is illuminated by white light, each step reflects a color that is determined by its thickness. The steps, therefore, are seen as a series of colored stripes on the glass plate.

To determine the thickness of an unknown film, it is compared with the colors on the gage to find the step which most nearly matches the color of the unknown film.

The new device will be used in the field of microchemistry for the measuring of very small amounts of a substance when the substance is laid down in a uniform film, such as occurs in the case of films formed by evaporation in vacuum. It can also be used, indirectly, to measure vapor pressures and temper colors on metals, and is adaptable for measurement of transparent conductive coatings on glass—such as aircraft windshields.

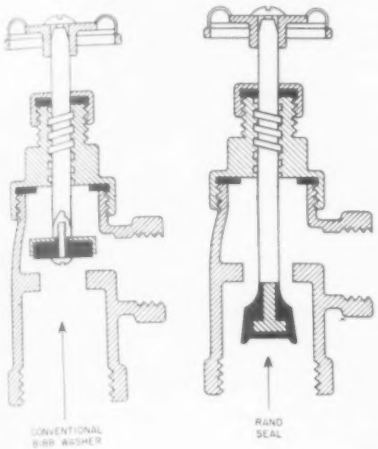
Range of the new gage is from 2 to 16 microinches. **T-1-861**

Index Table

The Web-Aire rotary index table is used for light milling, drilling, tapping and similar operations. It is table mounted on large ball bearings with large hardened steel stops. All moving parts are enclosed. It is rugged and compact, designed for long service and high production. Air operated, this model is 9 inches in diameter. Manufactured by Web-Aire Products Div., H. G. Weber & Co., Inc., Kiel, Wisconsin. **T-1-862**

Leak-Proof Valve

An innovation in the field of valve design, the Rand Seal, was announced recently by the Rodic Chemical and Rubber Corporation, Allen Ave., New Brunswick, New Jersey. Operating on a new principle, the Rand Seal makes possible a valve that is leak-proof, long wearing, easier operating and comparatively inexpensive to manufacture.



Operation of the Rand Seal is based on working with, rather than against, the fluid flow. The cone-shaped seal is closed in the same direction as the movement of the liquid, allowing high or low pressures to seal the valve. Leak-inducing permanent deformation found in previous designs based on the compression of a resilient member against a non-resilient seat is thereby eliminated.

The cup-shaped conical washer of the Rand Seal incorporates an imbedded metal plug which eliminates bending and warping and makes the seal leak-proof. If contaminants in the fluid, such as sand or grit, are not pushed ahead of one sealing line contact, the conical shape of the seal provides establishment of a new line contact without damage to the bore. The rubber member of the seal is compounded to withstand oil, grease, steam, water, and most industrial chemicals. **T-1-871**

Motor-Driven Trolley

A motor-driven trolley developed by the Philadelphia Div., Yale & Towne Manufacturing Co., is designed to increase load and operator safety, lower hoist maintenance costs, and eliminate trolley brakes and complex electrical speed-changing equipment. Source of these benefits is a hydraulic coupling which transmits power from the motor to the drive unit through a cushion of oil. Long used in automobiles, this is the first application of fluid transmissions to hoisting equipment, the maker claims.

Since the motor in the new Yale trolley starts unloaded and comes up to 85 percent of full speed before starting the load, there is no prolonged inrush of current. Power requirements are less than one-half of normal with accompanying reduction in motor heating and maintenance.

The fluid coupling completely replaces expensive accelerating speed control, eliminating the maintenance costs of this complex equipment.

The motor starts free of any load and is loaded gradually without vibration or jerking. There is no swinging of the load when the trolley stops the hoist travel. The freedom from shock to the load and motor provided by the fluid coupling permits actual reversal of the motor from full speed forward to full speed reverse, providing smooth yet rapid deceleration and stoppage or complete reversal. The motor eliminates the need for a motor brake on the trolley. The new Yale fluid coupling is available for all Yale power driven trolleys from ⅛ to 12-ton capacity. **T-1-872**

Only **MARVEL** *builds all four**

*HACK SAWING MACHINES
*BAND SAWING MACHINES
*BAND SAW BLADES
*HACK SAW BLADES

While it is true there are several builders of hack sawing machines and many builders of band sawing machines, only MARVEL builds BOTH hack saws and band saws. The fact is that MARVEL manufactures 35 models of 10 basic type of metal sawing machines which include the world's fastest automatic production saw, the world's largest giant hydraulic hack saws, the world's most versatile band saw and the most widely used small shop saws.
With intimate and broad field experience in all types of metal cutting-off equipment and 35 different saws available, it is obvious that MARVEL Field Engineers occupy a unique and exclusive position in the industry. They are eminently qualified to make expert and unbiased recommendations covering the type, size and model of metal sawing equipment best suited to individual requirements—that most efficient, most accurate, fastest, broadest in scope and the most economical.
MARVEL is also the only manufacturer of both metal sawing machines and metal sawing blades. Because the efficiencies of both the machine and the blades are interdependent, each upon the capability of the other, expert knowledge covering both saws and saw blades is essential to the proper appraisal of any specific sawing situation. Correct balance of cutting speed and blade life, feed pressure and blade tension are all potent factors in over-all performance. Here again it is the MARVEL Field Engineer who is qualified to provide the comprehensive answer to your question. His job is to help you saw metal most efficiently —his services are available upon request—gratis.

WRITE FOR CATALOG 49

ARMSTRONG-BLUM MFG. CO.
5700 Bloomingdale Ave., Chicago 39, U.S.A.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-87

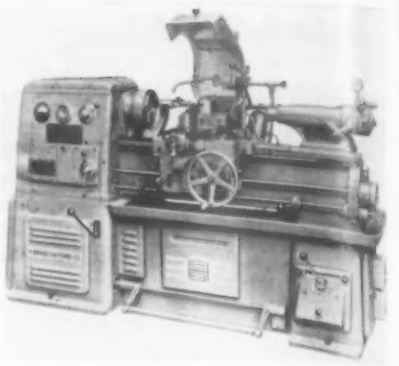
Copying Lathe

A high speed hydraulic copying or profiling lathe—the H. E. B.—has been introduced into this country and Canada by H. E. B. Machine Tools, Inc., 341 Madison Ave., N. Y. Delivery is immediate at this time. The lathes are designed and built in France by the H. Ernault-Batignolles Machine Tool Division of Batignolles-Chatillon Locomotive Co.

The H. E. B. copying lathe, Model OP, achieves elimination of vibration even at its top spindle speed of 3,600 rpm, giving maximum output from carbide and diamond tools, for which it was designed. The bed is heavily cross-braced, and together with a massive one-piece base, forms a foundation so rigid that it need not be bolted down.

The copying device is an integral part of the machine and has great sensitivity. The machine copies to within plus or minus 0.0004 in. on diameter. Rear tool maintains plus or minus 0.0002 in. on diameter, and axial lengths are copied to within 0.0015 in.

Copy turns from flat template or turned master. The number of parts between hydraulic tracer and cutting



tool has been reduced to a minimum, and all oil passages are short and rigid. There is no delay in the response of the cutting tool to the most minute impulse of the tracer.

Workpieces with numerous different diameters, tapers, chamfers, radii, contours, etc. are copy-turned with a single tool, in one continuous cut. The machine can also be used as an ordinary high-speed center lathe without adjustments. **T-1-881**

Sheet Metal Saw

Designed for production work in metal, plastic, sheet metal and woodworking shops, this saw has a chain drive gear which eliminates blade chatter and allows full power at slow speeds for cleaner, faster cutting of iron and

steel castings, forgings, etc. Speed range is from 125 to 2200 fpm giving quick selection of correct blade speed for material to be cut. Takes blade up to and including ½ in. width. Extra depth 8¾ in. cut is especially adaptable to finishing castings. Stacked (50 or more) galvanized sheet metal can be cut at speeds up to 15 in. per minute. The table, 20x22 in., is adequate for large work. Overall depth is 34 in., overall height, 34 in. Set of four sheet metal clamps and riser bar insert to match are included for sheet metal work. Available from Bett-Marr Manufacturing Co., Hopkins, Minn. **T-1-882**

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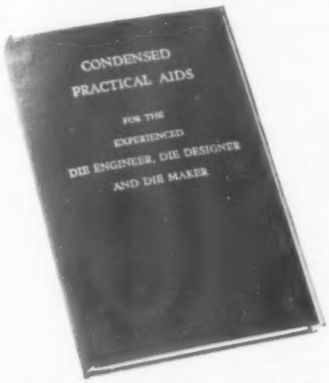
Here is the DIE BOOK you've always wanted!



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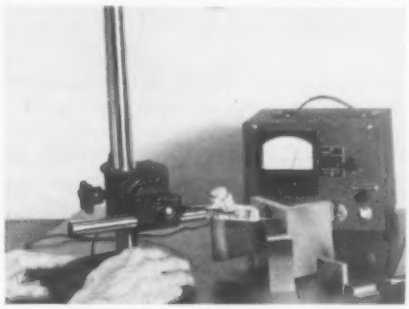
INDICATE A-1-89-1

Electronic Indicator

Graham-Mintel Instrument Co. announces the Indi-Ac electronic indicator—a portable, high-precision instrument for checking setups and run-out on the machine and for surface-plate work in shops, toolrooms, and gage rooms.



This instrument consists of an induction-type gage head adjustably mounted on a stand, and a high-stability 4-tube amplifier with a 2-scale meter. The gage head has a frictionless movement, with no mechanical amplification; the amplifier is free of drift; and readings are not affected by any ordinary changes in temperature of gage head or fluctuations in line voltage. Hence, consistent repeat readings are obtained at all times.

The meter has two continuous linear scales which read 0.0005 in. and 0.00005 in. or 0.0001 in. and 0.00001 in. per division, either side of zero. The two scales can be used interchangeably at will; and both scales always give the same reading for any measurement within their range. Meter response is instantaneous, without overshoot, permitting fast readings and dependable run-out measurements.

Write for Bulletin 101, to Graham-Mintel Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio. **T-1-891**

Slitting Saws

A carbide-tipped metal slitting saw for roughing and finishing, slitting and grooving operations on steel, cast iron, aluminum, and other nonferrous materials, is announced by North American Products Company, 3103 W. Cherry St., Milwaukee, Wisc.

These blades have taken production cuts in cast iron 6¾ in. deep, in steel 2¼ in. deep, and have held size to 0.002 in. on slots 4½ ft. long. They have increased cutting speeds four to five times over steel blades, and in one case cut through "Inconel X" when no other blade could be found to do the job. These blades are made from 3 to 18 in. in diameter in widths from 0.085 to ½ in. **T-1-892**

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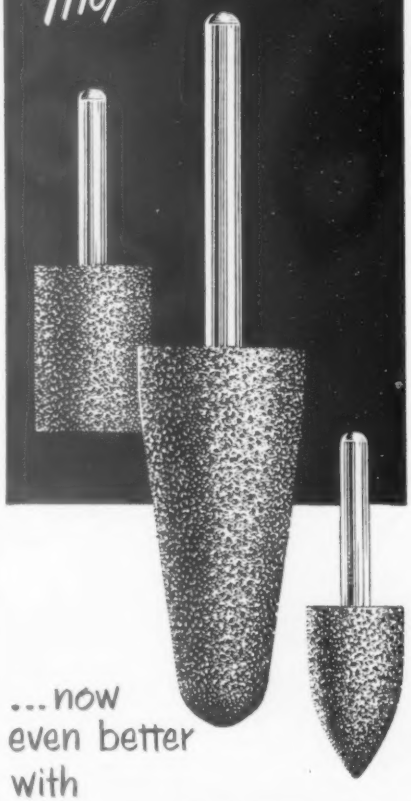

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OFFICES IN PRINCIPAL INDUSTRIAL CENTERS
INDICATE A-1-89-2

Welding Electrode

A resistance welding electrode, marketed under the name of Kaptrode, is announced by Weiger Weed & Company, 11644 Cloverdale Avenue, Detroit 4, Michigan, division of Fansteel Metallurgical Corporation.

The electrode consists of an expendable cap which fits into a semi-permanent adapter shank. This in turn fits into any standard Morse taper-type electrode holder. Depending upon the length of the adapter shank, copper savings up to 75 percent are possible.

Kaptrode electrodes are made in six nose styles (pointed, dome, flat, offset, truncated cone and radius face), in

three RWMA alloys (Class 1, 2 and 3), and two Morse taper sizes (No. 1 and 2).

Adapter shanks are made at present in two Morse taper sizes and nine lengths ranging in ¼-in. steps from 1¼ to 3¼ in. Other lengths are manufactured to specifications. All Kaptrode electrodes fit interchangeably into any adapter shank of the corresponding Morse taper size, and project ¾ in. from the shank. Thus, with the proper shank length, it is possible to duplicate standard electrode lengths and use Kaptrode electrodes without changing established machine set-ups.

Kaptrode electrodes, adapter shanks and extractors are described in detail in Technical Data Bulletin 14.100, obtainable from the maker. **T-1-901**

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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INCICATE A-1-90

Granite Surface Plate

A combination surface and angle plate of black granite (diabase) is being announced by Rahn Granite Surface Plate Co., 641 N. Western Ave., Dayton 7, Ohio. Illustrated is an 18 x 18 in. granite surface plate attached to the squared edge of a 24 x 36 in. granite surface plate.

The surfaces of the two plates are finished by a hand-lapping process to a claimed overall tolerance of 0.00005 in. on each plate. The edge of the larger plate is lapped to 90 deg with the top surface, so that, when the two plates are bolted together, every part of the projecting 18 x 13-in. surface is within 0.0002 in. of 90 deg with the plane of the larger plate.

Not only is this combination angle and surface plate accurate when made, but this accuracy will be maintained for a long time due to the nature of the black granite, which is harder than tool steel and has been heat-treated and normalized by nature for millions of years. The granite will not rust and, should it be accidentally nicked, no burr will be raised. Neither can abrasives become embedded in this hard material. **T-1-902**

High-Speed Hole Saws

The Millers Falls Co., Greenfield, Mass., has recently introduced a new line of high-speed, heavy-duty, follow-through type hole saws in sizes up to 4½ in. in diameter.

Using a high-speed steel edge welded to tough alloy steel back, these gang cutting tools are practically unbreakable in use and are capable of fast, clean cutting in any machinable material such as hard and mild steels, aluminum, brass and bronze, iron and steel pipes, plastics, etc.

Holes to a depth of 1⅛ in. may be cut in solid stock. In addition, because the body of the saw is slightly smaller than the cutting diameter, the complete tool follows through the hole it cuts.

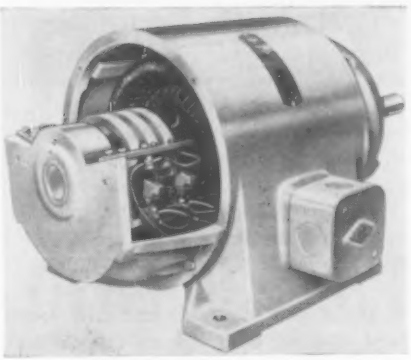
Blu-Mol hole saws can be used in portable power drills with ¼-in. chuck for the smaller sizes, ½ in. or larger on the bigger saws. Or they may be used in radial drills, lathes, drill presses, etc. The line includes 40 saw sizes ranging from ⅝ to 4½ in., 3 sizes of driving mandrels equipped with ¼-in. high-speed pilot drills, and a 12-in. mandrel extension.

T-1-911

Slip Ring Motor

This slip ring motor features a new arrangement of the collector rings and brush assembly which permits their complete housing in the motor's regular end bell. This development eliminates the traditional protrusion of the assembly and reduces the overall and other essential dimensions to those of a standard squirrel cage motor. Increased protection against arcing and flashing is also afforded.

Flat end bells provide added mounting versatility. Brakes and other equipment can be attached on either end using face or flange type mountings. Units can be mounted in any position.



Other features include shorter bearing-to-bearing spacing for greater shaft rigidity, wound rotor construction for maximum vibration resistance, and larger inspection openings for access to collector rings and brushes.

These motors are available separately in ratings from ¾ to 15 hp or, in conjunction with gear reducers, in ratings from ¾ to 5 hp; either drip-proof or totally enclosed.

Write for engineering data sheet No. SR-1000 to Reuland Electric Company, Alhambra, Calif. **T-1-912**

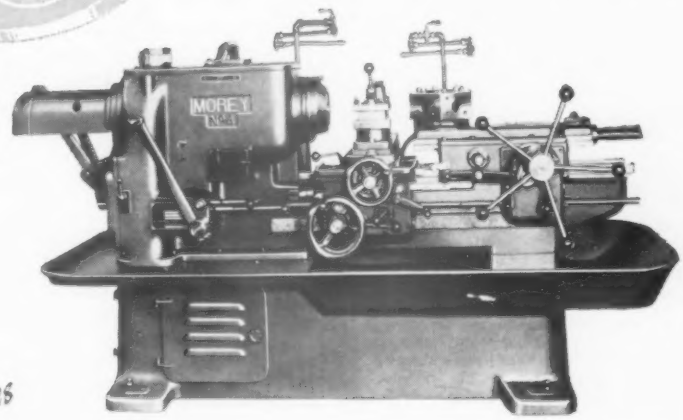
USE READER SERVICE CARD ON PAGE 99 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

MOREY

TURRET LATHES

No. 2 Plain Type

Nos. 3, 4 and 5 Universal Type



Features

Infinite variable vibrationless spindle speeds.

Remote speed selection control for speed and ease of operation.

The newly designed MOREY TURRET LATHES take advantage of tungsten carbide tools and incorporate all technical improvements in metals, electronics and hydraulics . . . our design is not hampered by tradition.

Size	Bar Capacity	Swing	Motor
No. 2 Plain	1" x 6"	14"	3 HP
No. 3 Universal	1⅛" x 10"	16½"	5 HP
No. 4 Universal	2" x 12"	19½"	7½ HP
No. 5 Universal	2½" x 14"	21¼"	15 HP

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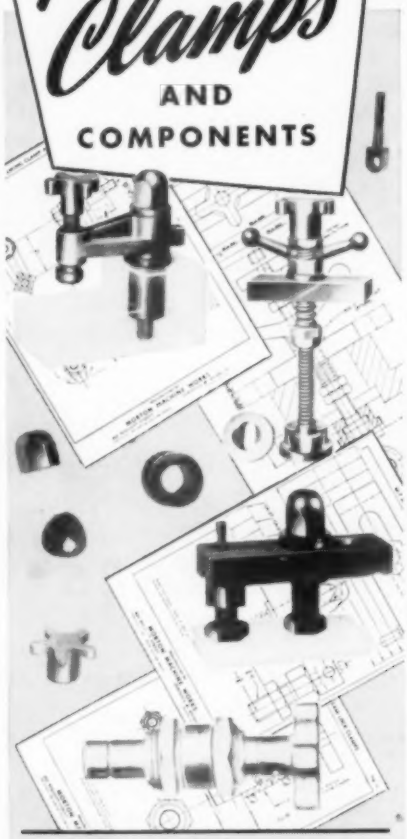
MORTON

Fixture Clamps AND COMPONENTS



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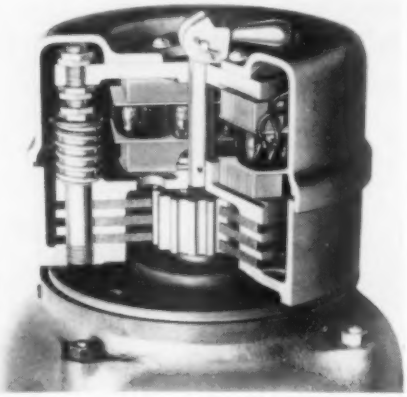
INDICATE A-1-92-1

Magnetic Brake

Dings Brakes, Inc., a subsidiary of Dings Magnetic Separator Company, 4740 W. Electric Ave., Milwaukee 46, Wis. announces the availability of a line of a-c or d-c direct-acting disc-type magnetic brakes.

This brake, according to the manufacturer, is designed to stop any motor instantly, to hold the load, and to release with no drag. The brake is spring-engaged and magnetically released and is designed to mount on Nema type C motor flanges.



The brake has no solenoids or mechanical linkages. Friction discs, springs and magnet constitute the heart of the unit. High thermal ratings are claimed for the brake. It is not necessary to dismantle the brake or disturb the torque setting in order to mount it. A manual release lever, located outside the housing, is standard. Use of the lever enables the operator to disengage the brake. This mechanism automatically resets itself, restores the unit to usual operating condition when power is again applied. Torque and wear adjustment is made by adjusting a double set of lock nuts. Visual inspection of position of manual release lever indicates when adjustment is necessary.

In adjusting, it is impossible for the operator to increase the torque beyond the ability of the magnet to release. In addition, the shell of the housing shrouds the rotating discs, enabling the operator to make adjustment with safety while the unit is in operation.

Standard units mount on horizontal motors but can be adapted for vertical mounting if so ordered. Brakes are fully enclosed, drip-proof and weather-proof. Special enclosures are also available. Leads on brakes can be connected to leads of either 220 or 440-volt motors. **T-1-921**

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THE BEST MACHINE and the finest operator cannot do the best work without the *right* cutting fluid.

Stuart combines theory and practice to give you the right cutting fluid for the job. Here is an example:

In a large gear department, cutting fluid tests were run on Gleason Revacycles cutting 8620 gear stock, 179 Brinnel hardness.

	"X" Oil	Stuart's SPEEDKUT "A"
Gears Per Tool Grind	1200	3200
Stock Removal to Recondition Cutters	.009"	.0035"
Price of Cutting Oil	33c/gal.	35c/gal.

There's a story! More production because of less downtime. Longer cutter life because of fewer grinds and less stock removal per grind. A lower *actual cost* for the cutting fluid.

You can get help like this from a Stuart Representative. Ask to have him call.

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Goes with every Barrel
Offices in Principal Industrial Centers

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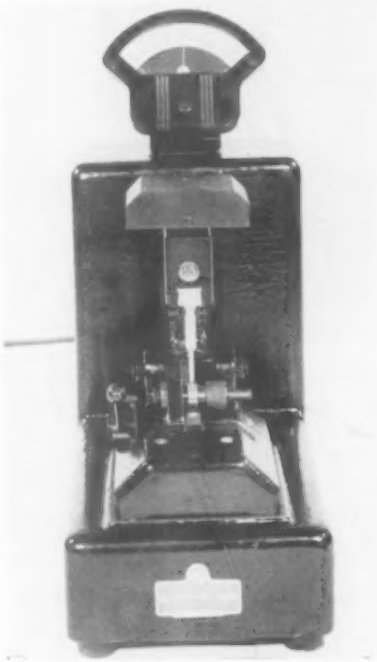
2727-49 S. Troy St., Chicago 23, Illinois

INDICATE A-1-92-2

Radial Play Gage

A comparator for measuring the radial play of ball bearings has been developed by Pratt & Whitney, Division Niles-Bement-Pond Co., West Hartford 1, Conn., in cooperation with New Departure Division, General Motors Corp.

Known as the Pratt & Whitney electrolimit internal clearance comparator —lever type, it is intended for gaging small precision instrument-type bearings. With interchangeable tooling it will handle bearings from 3/32 bore to 1/2-in. bore. The principal part of this comparator is the C-shaped sub-assembly. The bottom of this assembly is fitted with an arbor that holds the bear-



ing vertically and securely by its inner ring so that the outer ring is free to move according to the amount of radial play. An electrolimit gage head is attached to the upper portion of the C-frame so that its diamond-tipped gaging spindle bears against the top of the outer bearing ring. This presses the outer ring to the down position with all clearance at the bottom. At this point the first of two comparative readings is taken.

To obtain the second reading, the entire C-frame is tilted downward on pivots which support it over a sub-base. The bottom of the outer ring then contacts the stationary anvil. This presses the outer ring upward on the arbor so that all clearance is at the top. Here a second comparative reading is taken. The difference between the two readings represents the amount of radial clearance in the bearing assembly.

The frame is tilted by a lever-operated cam to bring the bearing in and out of contact with the stationary anvil.

T-1-931

DETREX 53

makes short work of dirt

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You save time . . . make short work of cleaning . . . when you use a spray-washer compound that's right for your job.

On steel, cast iron, magnesium and die castings, Detrex 53 is right! You get the best removal of oils, grease, shop dirt, chips, and other soils . . .

And these plus advantages:

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BOX 501, DETROIT 32, MICH.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-93

Band Saw Mount

The manufacturer of DoAll sawing machines announces an important design change in the mounting of saw tables on their Contour Machine line. This change increases the rigidity, minimizes deflection under load and eliminates vibration of the work table and still maintains a universal two-way tilt for angle cutting.

The lower saw guides can now be raised above the work table surface to give increased support to the blade. This change will be of special importance when an auxiliary table is used so that the lower guide can be brought up very close to the work.

The new design employs a semi-steel cradle 5½ in. in width which is bolted and doweled to the steel frame of the machine. A fitted trunnion, also of semi-steel, is bolted to the lower face of the work table and rides in the machined cradle. A locking nut and rachet-type locking lever enable the table to be set securely at any angle up to 45 deg right and 10 deg left.

T-1-941

WHEN YOU SPECIFY NELCO CARBIDE TOOLS . . .

METAL-CUTTING SERVICE is speedily available from your Nelco field engineer and distributor representative - trained and teamed to help you select the Nelco tools best suited to solve your production problems. And, service continues, long after the tool is performing on your machine! Trouble shooting, visits to you, and to your machines, make certain you are getting maximum production from these better Nelco tools.

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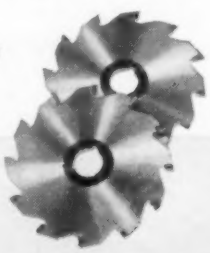
PERSONAL REPORTS — Your questions and inquiries meet with prompt, interested Nelco attention. Answers are prompt and deal specifically with *your individual request.* ★ **For that extra edge in production.** ★



NELCO TOOLS

NELCO TOOL CO. INC. • MANCHESTER, CONN.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-94

Portable Coolant Unit

This 30-gpm coolant unit, Model 10-10, is portable and will pump up to 12 ft. The unit was designed to furnish ample cooling for an eight- or ten-spindle drill press. It may be used on single-spindle drill press, lathe, broaching machine, cut-off machine or a cutter grinder either singly or with three or four different machines at the same time.

A special neoprene bearing in the lower part of the pump will not permit abrasives to imbed—thus there is little or no wear on the bearing shaft.

In the upper part of the pump is a ball thrust bearing and thrust collar that absorbs the constant impeller thrust rather than transferring it to the motor bearing.

The unit is self-contained, has a ¼ hp, 110-volt, 60-cycle motor, and built-in switch. Aluminum casting pump housing is tapped for one-inch pipe. Container holds 11 gallons, is 10 x 10 x 26 and comes complete with chip screen and sediment baffle. Neoprene hose is ⅜ in. by 6 ft long and is equipped with shut-off and flexible nozzle.

The Model 10-10 Coolant Unit is manufactured by Shellback Mfg. Co., 1320 E. Elza, Hazel Park, Mich.

T-1-942

Vane Type Rotary Pump

A heavy-duty, vane-type rotary pump has been added to the existing line of rotary pumps manufactured by Worthington Pump and Machinery Corp., Harrison, N. J.

All models are positive-displacement, sliding-vane type in which the pressure of the liquid being pumped maintains contact of the vanes against the liner.

The pumps are to be manufactured in both internal and external bearing design; the external bearing models are especially suited for non-lubricating liquids such as gasoline and kerosene. The pumps are manufactured with built-in relief valve and in either standard-fitted, bronze-fitted or in all bronze construction.

T-1-943

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"THINSAW"
CARBIDE TIPPED

Thin as .030"

You'll save time and rejects by using this new "Thinsaw" on production—precision slitting jobs.

Eliminates run-outs even on deep cuts

Thinnesses as low as .030"

Tolerances can be held to .0001"

Available in diameters up to 5"

Circular tip seat gives extra braze strength

Available in any grade carbide

Cuts free of run-out to full depth

Built without hub for close alignment in multiple cutting

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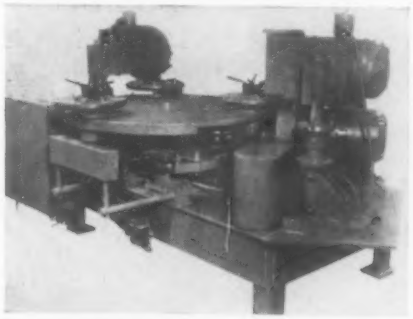
INDICATE A-1-95-1

Deburring Machine

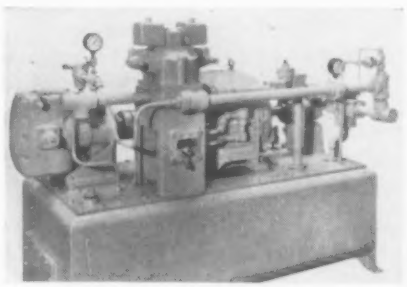
The development of a ring gear deburring machine is announced by General Riveters, Inc., 785 Hertel Avenue, Buffalo 7, N. Y. The machine is arranged for one unloading and loading position and two brushing stations. Each brushing station brushes top and bottom of the gear teeth.



The quick acting chucks permit the operator to unload and load the gears on a 6 to 7½ second cycle. The movements of the machine are all automatic and fitted with a time relay to adjust the timing of the cycle. The chuck in the loading position is held stationary, while loading, and starts revolving before it gets to the brushes. **T-1-951**

Control Unit

An oil hydraulic power and control unit, designed expressly for conversion of older, slow-speed hydraulic presses and extrusion machines to the higher speeds required by modern production, now is being manufactured by The Rucker Co., 4228 Hollis St., Oakland 8, Calif.



These units incorporate the conventional high-low pressure and volume construction, with a pressure-compensated high pressure circuit to hold pressure cycle at exact speeds desired. This construction enables the machine operator to secure needed cylinder speed quickly, yet by manual controls to alter pressing or extruding speed as job demands during operation.

The unit includes electrically controlled valving, decompression unit, micronic filters, and large oil reservoir tank, sized to meet specific job needs. The entire unit is constructed to JIC specifications. Sizes range up to 125 hp at 5000 psi. **T-1-952**

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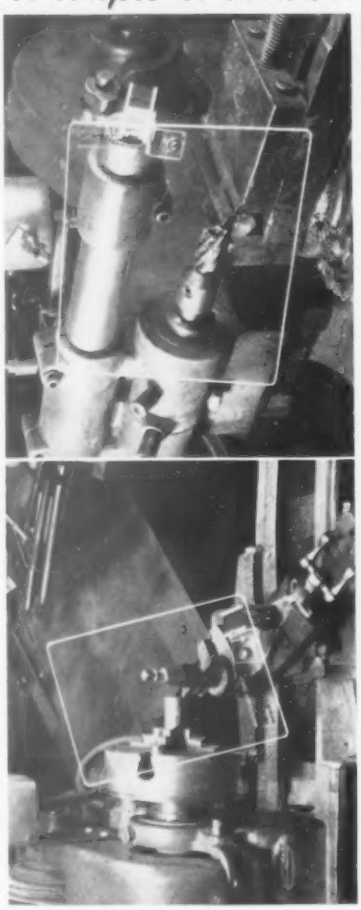

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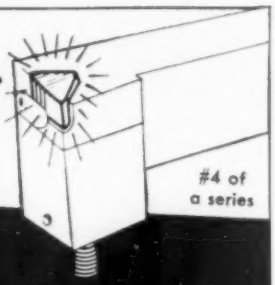
INDICATE A-1-95-2

Tool Saving Tips



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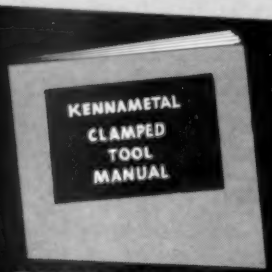

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Abstracts of Foreign Technical Literature

By M. Kronenberg

Great Britain: Theories which have been put forward to account for cratering on the face of sintered carbide tools are not very satisfactory according to a paper read by E. M. Trent before the Institute of Mechanical Engineers, London, and published in the British edition of *Machinery* of November 8.

The author indicates that these theories are, to a large extent, based on inferences from the properties of the materials and speculations of the metal cutting process which are not supported by very convincing evidence. His own investigations were therefore started from a new approach to the cratering problem which led to some new concepts of the wear process and the factors involved in tool life.

After commenting on the various theories presented abroad and in the United States on this subject, E. M. Trent offers his own explanation for the extremely rapid cratering of the tungsten-carbide cobalt types of tools when used at high cutting speeds. He explains that the cratering is caused by the formation of an extremely thin fused layer between chip and tool, consisting—when cutting steel—of an alloy of tungsten carbide with steel which melts at 2370 deg F. The superior performance of tools containing a small percentage of titanium carbide is attributed to the much higher resistance of the titanium tungsten carbide to chemical attack by steel at high temperatures.

The author claims that his theory may also be used to explain why tungsten-carbide cobalt alloys give satisfactory performance when cutting non-ferrous metals such as bronze, aluminum etc. The article is well illustrated by micro-photographs and sketches of the tests run by the author.

The Anglo-Iranian Oil Company has developed a dynamometer for torque and thrust in drilling operations which has been used for measuring loads exerted by twist drills. The device has proved, according to an article published in *Engineering* of October 19, to be of considerable value in research into the behavior of cutting fluids. The instrument has a maximum capacity of 4000 lb thrust and 100 lb-ft torque whereby deformations of internal parts are converted into electric impulses by means of attached strain gages. Test results are not given.

France: The numerous tracer control units which have been developed during the past years are mainly intended for operations where relatively small amounts of stock are removed from the workpiece. Lately, however, a copying device has been developed for a 80 hp lathe as described in an article by Edouard Blanpain, published in *La Machine Moderne* of October.

Recommendations for improving the performance of twist drills are published in an article in *La Machine Moderne* of September. According to French practice the cutting speed and the feed rate are made dependent on both the depth and the diameter of the hole. For the determination of the cutting speed it is suggested to multiply a standard cutting speed by a factor of $1-\left(\frac{\text{depth of hole}}{40 \times \text{diameter of hole}}\right)$. Likewise the feed rate should be calculated by multiplying a standard value adopted for the material by a factor of $1-\left(\frac{\text{depth of hole}}{50 \times \text{diameter of hole}}\right)$.

Germany: With the increase in cutting speeds and spindle revolutions it has become necessary to develop bearings for high precision machines which run with small clearances but do not heat up at high speeds, according to an article by E. Rotzoll published in January, 1951, in *Werkstattstechnik und Maschinenbau*.

He indicates that the full round or semicircular sleeve bearing does not satisfy these two contradictory requirements and that the so-called "Mackensen bearing" which has been developed several years ago has recently been improved. These bearings are of segmental type employing three rocking shoes to support the shaft according to hydrodynamic requirements in a similar way as the five segmental Filmatic bearing used in American grinding machines.

The author goes on to discuss the problem of high accuracy thrust bearings and reports that it is no longer necessary to combine a hydrodynamic bearing of the Mackensen type with a ball bearing for thrust. The hydrodynamic thrust bearings must be so designed as to provide the required wedge action of the oil film, which is illustrated in the article by sketches and diagrams. The wedges are incorporated into the thrust disks of the bearings at an angle of about 5 minutes. Such a bearing can support a load of about 350 lb when rotating at 1500 rpm on a shaft of about 3 in. diameter, and when petroleum is used as a lubricant.

The increasing use of press and shrink fits in the assembly of machines

(Continued on page 98)

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Abstracts of Foreign Technical Literature

(Continued from page 97)

was the cause for starting an investigation into methods for improving the coefficient of friction between the parts fitted together.

The tests were run by F. Wenk during fulfillment of a doctor's thesis and are published partially in an article by the same author in the September issue, *Werkstattstechnik und Maschinenbau.*

Since all surfaces produced in a machine shop are "contaminated" with tiny oil films which reduce friction it often is thought that the films can be removed by benzine and other similar liquids and that thereby the quality of the shrink fit would be improved. The author's tests proved, however, that no substantial progress is made in this way.

When the workpieces are heated as required for obtaining shrink fits an oxide film is generated which in general prevents contamination by oil film. Substantial increases in the coefficient of friction were obtained when both parts, the male and female parts, were heated. As an example, it was found that the coefficient of friction, which was about 0.25 for the case of washing in benzine, increased to 0.78 for the case of washing in ether and heating both parts to about 570 deg F. The inner parts, of course, had to be cooled again before assembly. The author also has developed a device for measuring the torque required for moving one part of the fit against the other.

Considerable damage has been caused by accidents occurring in the operation of woodworking machines, particularly milling machines, used in the machining of wood. E. Mosinkski has therefore investigated the limits for loads permissible at milling cutters, the methods of assembling the cutter blades and the cutting speeds which should not be exceeded in the case of such operations.

He has derived formulas for the design of these tools and reports on his finding in *Werkstattstechnik und Maschinenbau* of July. His derivations will not only be of interest to tool engineers in the woodworking industries but also to those in the metalworking industries because we are approaching cutting speeds in super high-speed milling of aluminum similar to those used in woodworking. It soon will be necessary—when designing cutters for such speeds—to take the centrifugal forces, the friction between cutter blade and cutter body and other such items into consideration which the author has derived for woodworking tools.

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

LITERATURE NUMBER	COMPANY	BULLETIN	DESCRIPTION
A-1-164-1	Ace Drill Bushing Co., Inc.	1101-2	Catalog deals with company's line of bushings for precision drilling.
A-1-20	Adamas Carbide Corp.	A851	Catalog covers Adamas tungsten carbide for tool tips, and wear parts.
A-1-128	Allegheny Ludlum Steel Corp.		"Tool Steel Handbook" presents in 196 pages its line of steels, their properties, applications and forms in which available.
A-1-30	F. E. Anderson Oil Co.		Twenty-page booklet contains information on machine cleaning, maintenance of Lusol solutions etc. plus case histories of product at work.
A-1-87	Armstrong-Blum Mfg. Co.	49	Company's line of hack and band sawing machines and saw blades covered in illustrated catalog.
A-1-151	The Bellows Co.	AV-300, CL-30	Two bulletins present case histories, wiring diagrams, and technical data on the Electroaire Valve and on pneumatic equipment, respectively.
A-1-171	Bethlehem Steel Co.		Color guide to aid steel users and treaters estimating temperatures of heated steels.
A-1-32	The Cincinnati Shaper Co.	B-3	Press brake catalog discusses company's line emphasizing advantages.
A-1-152-1	The Cleveland Tapping Machine Co.	T-11	Catalog on Cleveland tappers. Production tapping guide also available.
A-1-116	Crucible Steel Co. of America		Tool Steel Selector aids in choosing proper steel for particular use.
A-1-139	The Cushman Chuck Co.	64	Catalog covers wrench operated chucks in detail with engineering drawings and dimension data necessary for design and installation.
A-1-145	Danly Machine Specialties, Inc.		Booklet on Danly die sets stresses precision features of product and resultant economy in time, production and money.
A-1-89-1	"Die Techniques" Publishers	77	Bulletin discusses information contained in company's handbook on dies.
A-1-119	The Doall Co.		Twenty-four-page catalog on "Modern Measurement" control shows typical uses for DoAll blocks and explaining their need; describes complete line of sets, accessories, inspection laboratories and related equipment.
A-1-28	Gisholt Machine Co.		Illustrated 24-page catalog deals with company's hydraulic automatic lathes stressing speed, accuracy.
A-1-136	Gisholt Machine Co.		Bulletin presents facts on Gisholt 3L, 4L, 5L saddle type turret lathes.
A-1-152-4	Graham-Mintel Instrument Co.		Micro-ac bulletin gives full details on electronic comparator for checking gage blocks.
A-1-150	The Eastern Machine Screw Corp.		Various catalogs describe "Selecting Proper Die Head for the Job", style MM, style DMS, style DM and style TM machines for cutting screw threads.
A-1-88	Grobet File Co. of America, Inc.	HF2, HR2, F3, HB1, HC	Catalogs present information on Grobet's Swiss files, rotary files, rifflers, burs and countersinks, respectively.
A-1-3	Hardinge Brothers, Inc.	S	Brochure deals with style "S" master collets stressing special features, advantages.
A-1-84	Howe & Fant, Inc.		Literature covers company's Lign-o-matic turrets, stressing economy and production increase.
A-1-129	Jones & Lamson Machine Co.		Better threads at lower cost is theme of literature on die heads.
A-1-107-3	Kaufman Mfg. Co.	1150	Catalog gives information on precision tapping machines.
A-1-104	Kempsmith Machine Co.	127	Bulletin describes versatility and other advantages of milling machine.
A-1-10	The Lapointe Machine Tool Co.	D	Golden anniversary booklet, "Life was like that . . . before Broaching!", pictures period during Lapointe's founding and indicating progress since 1902.

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A-1-34	Latrobe Electric Steel Co.		Eighty-six page tool and die steel manual.
A-1-173	Mechanite Metal Corp.		Anniversary booklet, "25 Years of Proof in Service", relates Mechanite's place in the industry.
A-1-178	Metal Carbides Corp.	KL-52	Descriptive circular concerns company's "Klamp-Lok" insert holder.
A-1-140	Michigan Tool Co.	SS 1800-47	Bulletin tells about Michigan's Shear-Speed gear shaper, emphasizing speed and accuracy.
A-1-137	Micromatic Hone Corp.		"Cross Hatch" literature describing Microhoning on interrupted surfaces.
A-1-161	Miller Motor Co.	A-105, H-104	Illustrated cylinder bulletins stressing benefits of using Miller line; also copies of JIC hydraulic standards.
A-1-92-1	Morton Machine Works		Seventy-two page illustrated catalog shows complete line of fixture clamps; includes full size templates for tracing.
A-1-163	National Broach & Machine Co.	C-51-6	Detailed information and specifications for Red Ring Universal Gear checkers.
A-1-131	Norton Co.		"The A.B.C. of Surface Grinding" gives facts concerning efficient surface grinding.
A-1-164-1	Oakite Products, Inc.		Handbook, "Some Good Things to Know about Metal Cleaning", answers questions on the metal cleaning problems.
A-1-176	The Ohio Crankshaft Co.		Sixty-page catalog "Tocco Induction Heating" tells of cost-cutting solutions to these problems.
A-1-117	Ortman Miller Machine Co.		Catalog of O-M cylinders gives full details, data and specifications; also complete set of ½ scale templates showing cylinders and mounting brackets.
A-1-153	Plan-O-Mill Corp.		Booklet, "Solved: The Production Up-Curve Mystery" tells how to do high precision metal-working at top production speeds.
A-1-17	Pope Machinery Corp.	58A	Catalog covers two series of heavy duty precision motorized spindles with installation diagrams, engineering data and specifications.
A-1-1	Pratt & Whitney Div.	535	Complete descriptions and listings of P & W line in circular "Monocone and Duocone Dies and Holders".
A-1-156	Scully-Jones and Co.	6-50	Bulletin shows complete range of sizes, specifications and prices for adjustable adapters and spindle extension assemblies.
A-1-109-2	Severance Tool Industries, Inc.	CM	Complete information and prices on Severance ground-from-the-solid carbo-mills.
A-1-98	Simonds Abrasive Co.		Grinding data book contains facts pertinent to these problems.
A-1-115	Standard Tool Co.		"Tapping Data" provides help with metal cutting problems.
A-1-109-3	P. A. Sturtevant Co.		Data valuable to manufacturer, design and production men contained in "Sturtevant Torque Manual".
A-1-23	Sundstrand Machine Tool Co.	715, M-715	Complete information on standard Sundstrand Rigidmils and on Sundstrand magnetic fixtures, respectively.
A-1-124	Super Tool Co.	Supplement No. 5	Full particulars and net prices on standard tools now in stock.
A-1-169	U. S. Tool Co., Inc.	15-E	Complete specifications for U.S. Multi-Slides contained in bulletin emphasizing versatility and economy of product.
A-1-19	Valley Machinery & Supply Co.		Illustrated catalog presents new tip-brazing unit for metal working shops.
A-1-125	Walker-Turner Div.		Information and engineering data on complete line of Walker-Turner drill presses.
A-1-111-3	Waukesha Tool Co.		New catalog on Waukesha cutting tools describe manufacturing, engineering and designing facilities.
A-1-180-4	Zagar Tool, Inc.	T-1	Engineering manual on Zagar collet, holding and indexing fixtures.

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Technical Shorts . . .

POSSIBILITIES of further reduction of high alloys in aircraft engines, partly through the application of high temperature porcelain enamel coatings, are being studied by both the U. S. Air Force Power Plant and Materials Testing Laboratories at Wright Field. This goal was the subject of an informal talk by LT. COL. R. A. Jones, U.S.A.F., before the recent annual meeting of the Porcelain Enamel Institute.

High temperature porcelain enamels which function at temperatures of from 1600-1800 deg F under severe vibration and thermal stress and shock conditions are currently finding wide use in connection with turbo-jet engines. Although initial reasoning for the coating applications was as protection for the high alloy utilized because of its high physical properties, considerable savings became an attendant feature as a result of extended service life. Now, LT. COL. Jones pointed out, similar porcelain enamel coatings are being used on nearly all sheet metal parts, including tail exhaust cones, tail pipes, compression chamber interliners and directive vanes.

At the moment ceramic bodies rather than porcelain enamel are used in the extreme conditions brought about in connection with long range rockets—temperatures of from 5000-7000 deg F in combination with 200-500 psi compression. However, Lt. Col. Jones said a large field may be opening up in porcelain enamel coating of regenerative and cooling portions of the mechanisms, as well as in associated fields.

Possibly the greatest use of the coatings on ordinary steels, he stated, may fall under the heading of expendable items which must be adequately protected before and during their brief service prior to disposal.

A METHOD FOR cold extruding steel has been developed by Mullins Manufacturing Corp. which can be used to form commercial products. According to the researchers, this process, known as Koldflo, is cold extrusion plus the ability to extrude commercially on available presses and in combination with other press operations, and does not require special surface lubrication. Pressures required to make steel bar flow in the cold state are considered low.

Interest in cold extrusion of steel rose considerably after World War II when it was discovered that the Germans were using such a process in a limited way. However, a drawback to their technique was that it required very large presses, some of them exerting pressures up to 30,000 tons, and it used an elaborate method of lubricating the metal before it was extruded.

Mullins process, it is said, has versatility since it will coin, extrude forward and backward, compress, expand and iron. At the same time, flow of steel under pressure can be controlled so as to direct it where desired with a minimum of internal and external friction.

According to the engineers who developed the Koldflo method, advantages foreseen for the process include cost savings since only enough metal to make the part is cut from a solid bar, thus limiting scrap. At the same time, the process is said to be exact enough that weight and size tolerances can be held within limits required for most mass-produced, precision parts. Further their advantage is suggested by the fact that parts are produced with smooth surfaces, thereby avoiding extensive finish machining required by many products.

The company, which already is licensing manufacturers to use its process, is itself now building a plant in Warren, Ohio, which will go into operation shortly for the mass production of shells by this method.

DATA OF ESPECIAL value to designers, engineers and other production executives confronted with conservation problems in addition to their normal considerations, is being made available by Alloy Casting Institute.

The booklet serves as a guide to standard designations and chemical composition ranges for heat and corrosion resistant castings, and lists, in compact chart form, 27 cast alloy types recognized by the alloy casting industry as standard grades for service in extremes of temperature and highly corrosive conditions. The list provides an opportunity to select proven compositions when present critical alloy shortages require users to choose a substitute for grades previously employed.

Copies of the folder, "ACI Standard Designations and Chemical Composition Ranges for Heat and Corrosion Resistant Castings," may be obtained from E. A. Schoefer, Executive Secretary, Alloy Casting Institute, 32 Third Ave., Mineola, N. Y., or from member companies.

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Free Booklets and Catalogs Currently Offered By Manufacturers

Cutting Oils

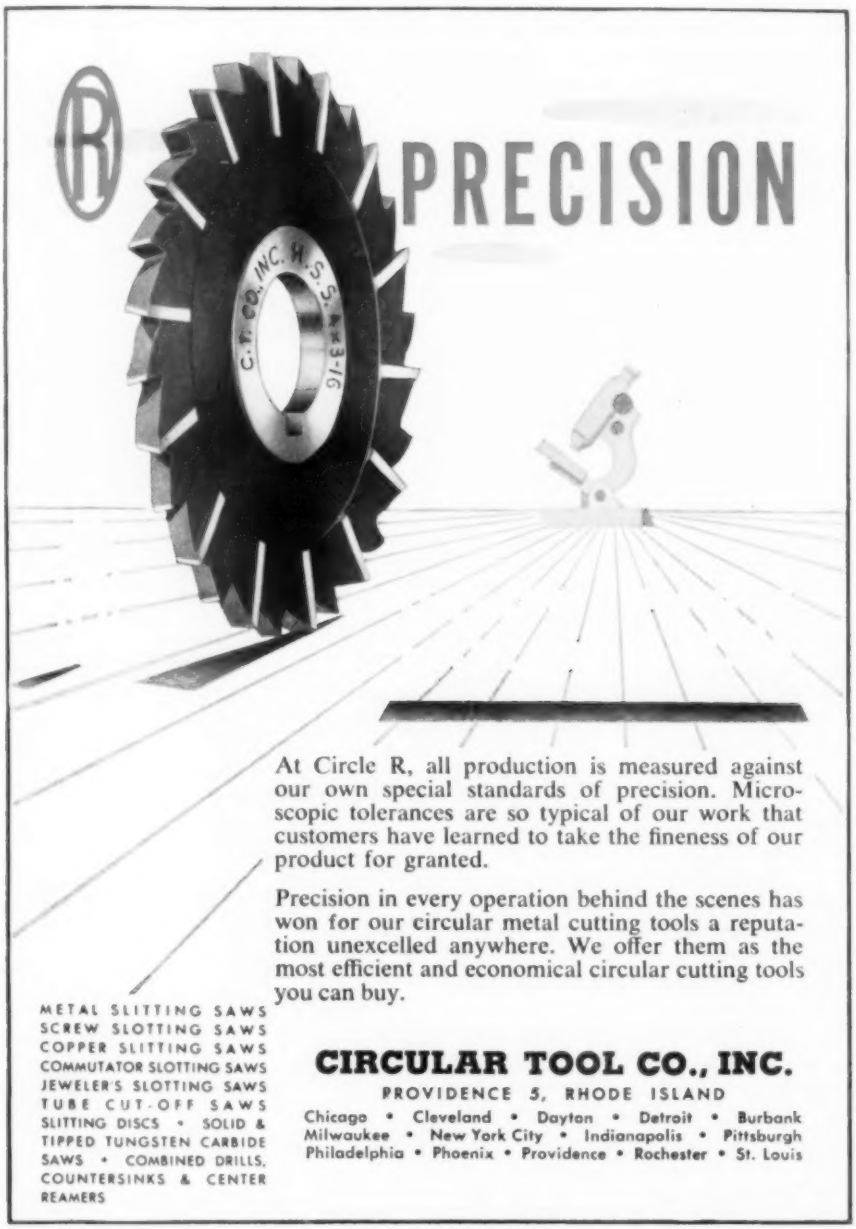
Interesting booklet, "Getting Down to Cases on Metal Cutting", contains case histories with factual information on performance records of machining operations in which Houghton's "Antisep" was used, stressing economy, lengthened life and production increase; includes machine feeds and speeds, types of machines, grades of steel and dilutions of cutting fluids used. **E. F. Houghton & Co.**, 303 W. Lehigh Ave., Philadelphia 33. **L-1-1**

Storage Racks

Catalog sheet describes prefabricated structural type pallet racks; drawings show construction features. **Equipment Mfg. Co.**, P.O. Box 3838, Detroit 5. **L-1-2**

Gear Chucks

Illustrated brochure explains company consultation, engineering and experience that go into their custom-built pitch line control gear chucks; shows typical installations. **Garrison Machine Works, Inc.**, Dayton, Ohio. **L-1-3**



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Tube Bending

Illustrated brochure deals with company's automatic "Bend-ex" air compression tubular bending machine emphasizing economy in man-hours and increased production—claiming more than 900 bends per hour; drawings explain steps in machine operation. **Paul Machine Tool & Die Works**, 4600 S. Kedzie Ave., Chicago 32. **L-1-4**

Press Brakes

Catalog 907 features complete information and specifications on company's 1500 and 2000 series all steel, power, press brakes and steel forming dies for heavy sheet metal and light plate work, stressing advantages of die space, stroke and throat depth. Machinery Div., **Airtherm Manufacturing Co.**, 776 S. Spring Ave., St. Louis. **L-1-5**

Centers

Pocket-size catalog folder describes and illustrates complete line of "Red-E" antifriction, carbide and high speed centers, tool holders, grinding and milling dogs and accessories. **Ready Tool Co.**, 554 Iranistan Ave., Bridgeport 5, Conn. **L-1-6**

Drills

Fifty-two page catalog and price list shows spade and core drills in stock sizes 1 1/64 to 5 in. dia. in steps of 1/64 in. interchangeable in eight sizes of holders, with and without oil holes, made in various types for use on regular shop equipment. **Conner Tool & Cutter Co.**, 1000 E. McNichols Rd., Detroit 3. **L-1-7**

Millers, Profilers

Illustrated brochure covers construction details, specifications, typical work production and other features of 30- and 40-in. vertical millers and profilers. **Pratt & Whitney** Div. Niles-Bement-Pond Co., West Hartford 1, Conn. **L-1-8**

Steel, Plastic Mold

Practical guide to selection, application and heat treatment of steels for plastic molding contained in 40-page book "Tooling Up for Plastics"; selector table gives in brief form application of line of mold steels, together with their characteristics. **The Carpenter Steel Co.**, Reading, Pa. **L-1-9**

Turret Lathes

Eight-page brochure describes Model 3U "Speed-Flex" automatic turret lathes; drawings and close-up photos point out advantages and main features of construction; table lists dimensions and specifications. **Potter & Johnston Co.**, Pawtucket, R. I. **L-1-10**

Pumps

Folder 52B6351B, "Allis-Chalmers Type SSB General Purpose Pumps", deals with construction details on company's grease-lubricated pedestal-mounted general purpose pumps; cross-sectional and dimensional drawings point out main features and advantages. **Allis-Chalmers Mfg. Co.**, Milwaukee 1, Wis. **L-1-11**

Welding Electrodes

Illustrated bulletin AR51-1, "Alloy Welding Electrodes for Defense Production", discusses various types of electrodes in connection with armor welding, low hydrogen ferritic and corrosion resistance-high temperature classes, and their uses in wide variety of applications. Table outlines chemical and mechanical properties. **Alloy Rods Co.**, York, Pa. **L-1-12**

Die Springs

Spring Bulletin 1951 shows line of Die-Co Die springs with a price list of nearly 500 stock sizes; stresses performance, quality and other advantages. **The Die Supply Co.**, 1400 Brookpark Rd., Cleveland. **L-1-13**

Threading

Brochure explains "Camming for H & G Self-Opening Die Heads on Automatic Screw Machines"; drawings and photos illustrate particular points in operation and application. **The Eastern Machine Screw Corp.**, Truman & Barclay Sts., New Haven 6, Conn. **L-1-14**

Clutches, Floating Disc

Catalog-data book illustrates and describes line of standard floating disc clutches, in sizes from ¼ to 15 hp at 100 rpm, and the Maxitorq automatic overload release clutch; includes engineering drawings and specifications. **The Carlyle Johnson Machine Co.**, Manchester, Conn. **L-1-15**

Press Brakes

Bulletin 107 points out special design features, economy and production advantages of company's power press brakes; includes illustrations and specification tables of various models. **Columbia Machinery and Engineering Corp.**, Hamilton, Ohio. **L-1-16**

Stress Analysis

Revised up-to-date edition of "Photoelastic Stress Analysis" discusses principles, usefulness and advantages of this method of solving problems of stress distribution; covers apparatus needed for production, materials suitable for the testing models and other pertinent points; includes bibliography of books and articles on the subject. 35c. **Eastman Kodak Co.**, Rochester 4, N. Y. **L-1-17**

Abrasives

Three catalog bulletins discuss company's abrasives for various uses and applications. Form ESA-54 deals with nut- and bolt-inserted abrasive discs and cylinders for horizontal or vertical spindle disc and surface grinding operations; includes grain and grade recommendations. ESA-65-A illustrates and describes line of abrasive mounted wheels and points with removable spindles, emphasizing simplicity. AH-22 presents detailed information on grinding wheels and abrasive grain specifically used in building and construction trades. **Simonds Abrasive Co.**, Philadelphia 37. **L-1-18**

Gages, Comparator

Illustrated brochure, 8004, contains information on line of pneumatically operated gaging equipment; describes basic operating principle, adaptability, applications and advantages. **Moore Products Co.**, H & Lycoming Sts., Philadelphia 24. **L-1-19**

Chucks

Recently introduced styles of chucks and additional sizes of previously announced series are featured in catalog 63 illustrated by photos and diagrams; close-up pictures of manufacturing operations demonstrate manufacturing standards. **Union Mfg. Co.**, New Britain, Conn. **L-1-20**

Warplis

Nearly 400 Stock sizes

ROUNDS—Warplis Drill Rod

FLATS and SQUARES—Warplis Flat Stock

. . . oil hardening, *non-warping*, cold melt electric furnace tool steel . . . precision ground, true to size and section; decarb-free. From fine steel distributors everywhere. Descriptive folders on request.

Analysis:
C. .90 Mn. 1.10
Cr. .50 Tung. .50
Vanadium .15

PITTSBURGH TOOL STEEL WIRE CO.

Since 1902 . . . makers of cold finished fine steels in all sizes, grades and shapes

MONACA, PA.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-103

North East West South IN INDUSTRY

Ralph R. Kelley has joined **Brooks and Perkins, Inc.**, as general superintendent of the company's magnesium rolling mill to be called the Livonia Mill Division. Mr. Kelley, who has had 22 years of engineering and supervising experience in the rolling of light metals, was previously associated with the Aluminum Company of America. It is anticipated that B&P will start production at the new mill early in 1952.

Edward A Green has been named manager of product planning of the **General Electric Company's** small and medium motor department. Mr. Green, who formerly has been staff assistant to the general sales manager of the Small Apparatus Division, will be responsible for deciding what motor products will most profitably meet market needs and when these products should be introduced.

Versatile Kempsmith Milling Machine Proves Ideal for Long Production Runs

You'll find the new Kempsmith LH Miller gives you a rugged, lightweight machine that combines simple, rigid construction with maximum flexibility. It enables you to attain your production goals on such jobs as small end milling, high speed jig boring, keywaying, oil grooving, light straddle milling, etc. Designed by experienced Kempsmith Engineers . . . men who have met the milling machine requirements of industry for more than 60 years. Write for your copy of Bulletin No. 127 describing this versatile machine.

KEMPSMITH MACHINE CO.
1847 SOUTH 71ST STREET
MILWAUKEE 14, WISCONSIN, U. S. A.

KEMPSMITH LH MILLER

LOW in Initial Cost and Upkeep
HIGH in Accuracy and Rigidity

KEMPSMITH
Precision Built Milling Machines Since 1888

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-104

At a recent election, **Arthur L. Stewart**, vice president of **Geason Works**, was named vice chairman of the board. At the same time **Frederick E. McMullen, Dwight VandeVate** and **William M. Woodruff** were elected vice presidents of the company. All other officers were reelected.

Mr. McMullen, who has been a director since 1950, will be in charge of engineering. Mr. VandeVate, who will be in charge of manufacturing, will also continue as works manager. He was elected a director last year. Mr. Woodruff, also a director since 1950, will be in charge of sales and will continue in the post of export manager.

Elected at the **Gray Iron Founders' Society's** recent annual meeting in Chicago were the following officers: president, **E. L. Roth**, Motor Castings Company; vice president, **R. G. Schaefer**, Schaefer-Goodnow Foundries, Inc.; secretary, **H. P. Good**, Textile Machine Works; and treasurer, **H. J. Trenkamp**, The Ohio Foundry Company.

Charles S. Craigmile, president and director of the Belden Manufacturing Company was elected president of the **National Metal Trades Association** at that organization's recent annual convention.

Others elected to office were **Earle S. Day**, vice president and general manager of Collyer Insulated Wire Company, first vice president; and **Norman L. Rowe**, vice president of Ideal Roller and Manufacturing Company, second vice president.

Norman B. Weinke, who for a number of years has been production manager and recently sales manager of **Cullman Wheel Company**, has been elected vice president of the company. In this capacity, Mr. Weinke will head an expanded sales organization and also be in charge of manufacturing.

Another official recently elected at Cullman Wheel was **E. W. Meyers** who became secretary of the company. Mr. Meyers has served the organization for several years as a purchasing executive and advertising manager.

OBITUARY

Leon R. Ludwig, director of engineering and research for **Westinghouse Electric Corporation's** Atomic Power Division, died recently following a short illness.

John R. McDonald, president of the **Peerless Machine Co.** died recently

Harvey **J. Hincker** recently was appointed chief engineer of the automatic department of the **Automatic Transportation Company.** Mr. Hincker returns to the industrial truck manufacturing firm after more recent association with Buda Company as supervisor of design and research in the materials handling division.

Harvey J. Hincker

Alan R. Burman

At a recent director's meeting, **Alan R. Burman** was appointed to the board of directors and the position of vice president of the **Cro-Plate Company.** Mr. Burman has been connected with Cro-Plate since returning from service during World War II.

Warren G. Rosendahl has been named assistant general manager of **Clearing Machine Corporation's** recently organized Hamilton division. Mr. Rosendahl formerly was an officer of Hamilton-Thomas Corporation from which Clearing purchased the plant it now occupies in Hamilton, Ohio.

B. W. Wild has been named assistant works manager at **Columbia Machinery and Engineering Corporation** with the assignment of expanding and consolidating plant operations to increase production. Mr. Wild formerly was associated with Bendix Aviation Corporation.

A. J. McAllister has been named president and general manager of the Detroit Gear Division of **Borg-Warner Corporation.** Until recently, Mr. McAllister held these same positions with the Fairfield Manufacturing Company where he was associated for 25 years.

Also from Borg-Warner has come announcement of the appointments of **Robert J. Minshall** as president and general manager and of **G. V. Patrick** as vice president and assistant general manager of the corporation's Marvel-Schebler Products Division. Mr. Marshall is also president of the Pesco Products Division.

Coming Meetings

Jan. 14-17. Third **Plant Maintenance Conference,** to be held concurrently with Plant Maintenance Show; Convention Hall, Philadelphia.

Mar. 17-21. **1952 Industrial Exposition** sponsored by **American Society of Tool Engineers** simultaneously with ASTE's 20th Annual Meeting; International Amphitheatre, Chicago.

Frank W. Smith, vice president in charge of **Norton Company's** grinding machine division operations, has retired after 33 years of service with that organization. Mr. Smith will remain with Norton as a consultant responsible for the construction of the company's $6,000,000 machine division expansion.

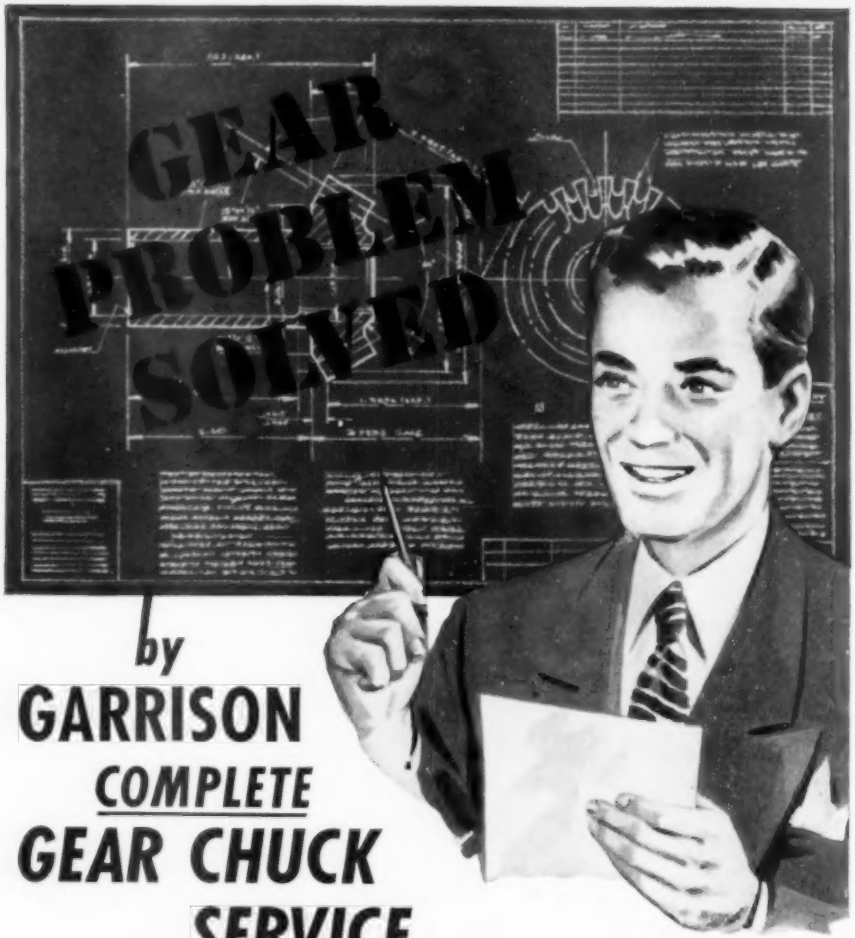
Members of the **Industrial Truck Association** at their recent annual meeting unanimously elected **Walter E. Schirmer** president for the coming year. Mr. Schirmer is vice president of The Clark Equipment Co.

Prentice Borden, general manager of The Crescent Truck Co., was voted vice president of the association.

The **Hanson-Van Winkle-Munning Company** has announced the appointment of **Bernard C. Case** as manager of electrochemical development. Mr. Case, who formerly was field engineer at Detroit, was recently honored for his work as vice-chairman of the research committee of the American Electroplaters' Society.

Promotion of **John L. Fuller** to the recently created post of manager of research and technical services has been announced from the **Reliance Electric & Engineering Company.** Mr. Fuller formerly was technical co-ordinator in the company's engineering department.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-105



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GARRISON
COMPLETE
GEAR CHUCK
SERVICE

Garrison Gear Chuck Service starts with your gear print and follows through with a complete service for the life of the chuck. Over thirty years of experience in designing and manufacturing pitch line control gear chucks exclusively, has built up a wealth of engineering knowledge. This knowledge is applied to designing the best custom-built gear chucks for solving your gear problems.

✓ For detailed information as to equipment and price, mail us your gear prints marked to show the operation to be performed and the machine or machines used.

Garrison
MACHINE WORKS, INC.
DAYTON 4, OHIO

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-106

Good Reading

A GUIDE TO SIGNIFICANT BOOKS AND PAMPHLETS OF INTEREST TO TOOL ENGINEERS

REPORT PREPARATION, by Frank Kerekes and Robley Winfrey. Published by the Iowa State College Press, Ames, Iowa. 450 pp; price $6.90.

This book, which presents the best of business correspondence by nationally known industrial firms, was prepared primarily to train engineers in writing scientific papers and reports. As such, it is an invaluable reference and guide not only to tool engineers, but to all who must write reports, business letters and technical summaries as a part of their daily work.

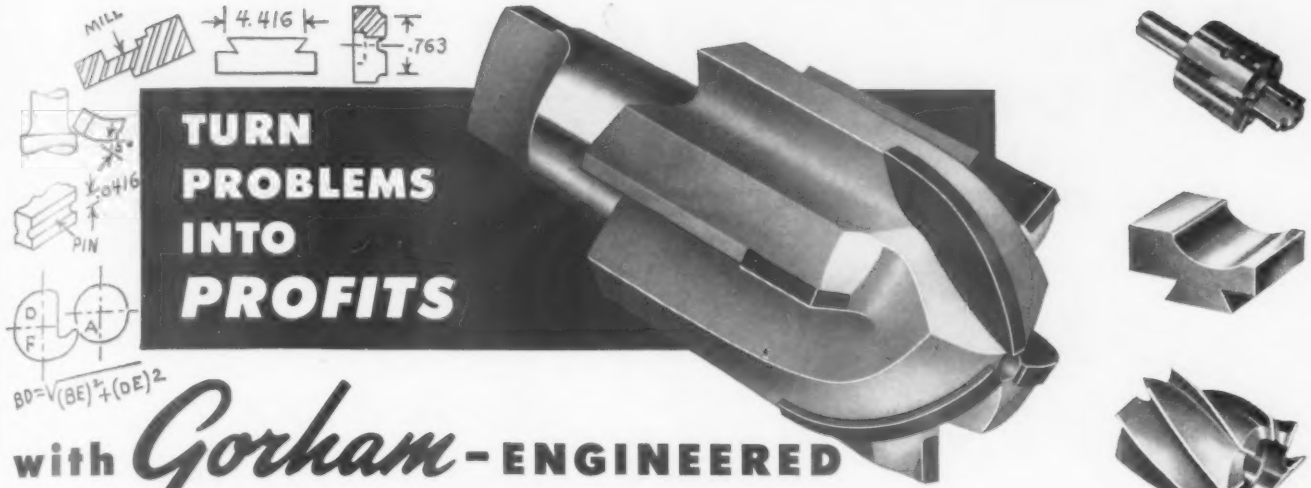
Believing that an illustration is worth many words of description, the authors have assembled a hundred or more specimens of actual blue prints, photostat copies, graphs, exact letters on company letterheads, and similar demonstration material. In this connection, review of this book became more than ordinarily pleasant since, in addition to interesting and instructive reading, writings by ASTE members who are known for their care with correspondence and technical writing are included.

NOMOGRAPHIC CHARTS by C. A. Kulmann. Published by the McGraw-Hill Book Company, New York, N. Y. 250 pp, price $6.50.

Compiled in this volume are 92 charts which are designed to simplify the solution of time-consuming computation problems encountered daily by the engineer. Based upon actual problems, the charts enable the engineer to arrive at preliminary solutions to problems without looking up in various tables the values of numerous items. The author says he has used these charts for more than 20 years in his work as a consulting engineer to eliminate a good percentage of routine work, and provide, in many instances, solutions with an even greater accuracy than can be achieved with a slide rule.

The charts include alignment-type charts, intersection-type charts, and combinations of the two. Five categories of frequently-used engineering computations are covered: functional scales (mainly exponential); mechanics; thermodynamics; electrical; hydraulics and hydraulic equipment.

(Continued on page 108)



TURN PROBLEMS INTO PROFITS

with Gorham-ENGINEERED SPECIAL CUTTING TOOLS

Next time you're up against a tough tooling problem, call in the man who can give you *the right answers fast* . . . your nearby Gorham Field Engineer! He's an expert in special cutting tools . . . and he's ready to provide a complete engineering service to determine your exact tooling requirements. He starts with your product, sketch or idea. He surveys your production operations and available equipment. He considers work material properties and desired finishes and tolerances. He plots proper machine feed, speed and method of tool driving. Then he develops practical design and engineering specifications for special cutting tools, metallurgically "tailor-made" for your application.

His recommendations are backed by Gorham's unmatched facilities, which include three fully-equipped modern plants, a large Engineering and Metallurgical staff, and a force of field application engineers in principal industrial centers, coast-to-coast. All are dedicated to furnishing prompt and profitable solutions to your special tooling problems. Gorham-engineered "specials" are turning problems into profits in thousands of plants every day . . . why not let them do the same for *you?* If you haven't met your nearby Gorham Field Engineer, write for his name, or send details of your problem direct for recommendations.

Gorham TOOL COMPANY
"EVERYTHING IN STANDARD AND SPECIAL CUTTING TOOLS"
14407 WOODROW WILSON • DETROIT 3, MICHIGAN

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ELIMINATE* HUMAN ERRORS WITH INDICATING MICROMETER & COMPARATOR

COMPARATOR
MASTER
MICROMETER
GO-NO GO GAGE
1" RANGE IN
10000ths-NO GAGE
BLOCKS NEEDED

* HUMAN ERRORS THROUGH DIFFERENCES OF "FEEL" ELIMINATED.
WILL DETECT OUT-OF-ROUNDNESS, OVALNESS AND TAPER.

SEND FOR ILLUSTRATED CIRCULAR

GEORGE SCHERR CO., Inc.
200C LAFAYETTE ST. • NEW YORK 12, N.Y.

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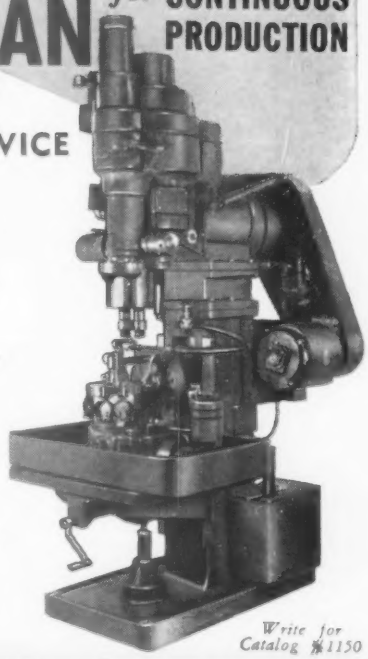
PRECISION BUILT TAPPING MACHINES

KAUFMAN *for* CONTINUOUS PRODUCTION

HI-DUTY PRECISION SERVICE



- Fully automatic cycle.
- Lead Screw control with rapid traverse.
- Long wearing — instant reversing clutches.
- All internal moving parts run in oil bath.
- Speed changes by Selective Gearing.
- Quick changeover to handle various jobs.
- Can be used with single spindle or with multiple spindle heads.
- With or without automatic indexing fixture.

Write for Catalog #1150

KAUFMAN MFG. CO.
MANITOWOC, WISCONSIN

USE READER SERVICE CARD; INDICATE A-1-107-3

Never Before

SO MANY ADVANTAGES for HIGHEST PRODUCTION

4800 PER HOUR!
3800 PER HOUR!
2500 PER HOUR!

For Top Production

SNOW

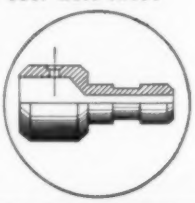
FULL UNIVERSAL MACHINES

Air operated, electrically controlled Snow tools are establishing amazing production records daily on a wide variety of work. Just note these typical examples:

DRILLING

Crossdrill and C"T" Sink 1/16" Hole

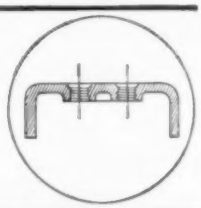
Material—Brass
Production—4800 per hour
Fixture—#15 Vertical index
Equipment—#1-UD Drilling Machine



TAPPING

Tap Two #10-32 Holes

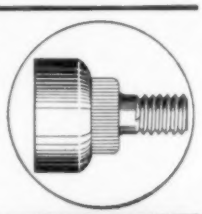
Material—Steel stamping
Production—3800 tapped holes per hour
Fixture—#14 horizontal index
Equipment—#1-UT tapping machine



THREADING

3/8"—24 Thread—1/2" Long

Material—Die Cast Aluminum
Production—2500 per hour
Fixture—#10 Drum dial
Equipment—#3-TR Threading machine



Snow air operated—electrically controlled machines have built in full universal controls that allow selection of the type of spindle cycle desired. This feature also permits instant synchronization of the standard Snow Master Fixtures. All types of air operated automatic and semi-automatic jigs and fixtures are carried in stock. Standardization permits low cost tooling—and—high production.

Sensitivity of power application prevents tool breakage.

Simplicity of control means that set up and operation can be handled by a less experienced operator with minimum fatigue.

SNOW

MANUFACTURING COMPANY
435 Eastern Ave., Bellwood, Illinois
(Chicago Suburb)

Single Spindle Verticals • Two-Spindle Verticals • Two-Spindle Horizontals • Automatic Nut Tapping Machines • Drill Press Tap Heads • Automatic & Semi-Automatic Jigs & Fixtures

Submit Sample Parts f

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-108

Good Reading

(Continued from page 106)

SIMPLIFIED MECHANICS AND STRENGTH OF MATERIALS by Harry Parker. Published by John Wiley and Sons, Inc., New York, N. Y. 275 pp. Price, $4.00.

This volume is the latest in the "simplified" series by this author, and like the others, is designed for the reader who has not had formal preparation. Since strength of materials is one of the basic tools used by the engineer, this straightforward presentation should be valuable to those interested in mechanics and construction.

The treatment of the subject here does not involve the usual higher mathematics such as calculus and trigonometry. A working knowledge of arithmetic and algebra will suffice to understand the problems and examples given, most of which are of a practical nature encountered in engineering and construction work. Also included are tables of allowable stresses, properties of sections and others giving useful engineering data.

PUNCHING, SHEARING, BENDING, by William C. Tucker. Published by Buffalo Forge Co., Buffalo, N.Y. 80 pp.; price $3.00.

A pocket size book in three parts, it gives general information on punching: tools, procedures and machines, with tables. Part II takes in shearing, along with average ultimate strength of materials, while Part III takes in bending of sheets, angles and structural shapes. While somewhat generalized since it is not intended to cover the entire field of punching, it nevertheless covers punching, shearing and bending as performed on the types of machines most widely used in metal fabricating.

THEORY OF ELASTICITY by S. Timoshenko and J. N. Goodier. Published by the McGraw-Hill Book Company, New York, N. Y. Second edition, 506 pp, price $9.50.

The authors, who are professors of engineering mechanics at Stanford University, have revised and modernized the volume and have added considerable material. The brief treat of the photoelastic method contained in the first edition has been rewritten and expanded into a new chapter which covers more fully the principles, theory and results of this procedure. An introductory account of the frozen stress method is also included.

The chapter on the use of complex variables in the solution of two-dimensional problems has been replaced and a new chapter on thermal stress has been added. In addition to a variety of other new material, an appendix on the method of finite differences and its applications.

Lower Cost PER SET-UP

In making set-ups for tapping and reaming, the cost can be appreciably reduced by simply using a Ziegler Tool Holder instead of an ordinary tool holder.

This is because, with the Ziegler Holder, it is not necessary to spend so much time in aligning the work with the spindle. Just align the work within 1/32" on the radius (or 1/16" on the diameter) and the Ziegler Holder automatically compensates for the difference.

Get a Ziegler Floating Holder and time how long it takes to make a set-up as compared with an ordinary tool holder. You'll see then how quickly the Ziegler Holder will pay for itself in labor-costs saved.

W. M. ZIEGLER TOOL COMPANY
13574 Auburn Avenue — Detroit 23, Michigan

WRITE FOR CATALOO

Ziegler ROLLER DRIVE FLOATING HOLDER for Taps and Reamers...

USE READER SERVICE CARD; INDICATE A-1-109-1

Over 85% of the torque wrenches used in industry are

STURTEVANT TORQUE WRENCHES

Read by Sight, Sound or Feel

- Permanently Accurate
- Practically Indestructible
- Faster—Easier to use
- Automatic Release
- All Capacities

in inch ounces
...inch pounds
...foot pounds
(All sizes from 0-6000 ft. lbs.)

Every manufacturer, design and production man should have this valuable data. Sent upon request.

P.A. STURTEVANT CO.
ADDISON QUALITY ILLINOIS

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Severance CARBO-MILLS GROUND-from-the-Solid

SOLID CARBIDE CUTTING HEADS

The all-purpose CARBIDE mill at LOW cost. Use them same as you would High Speed mills or Rotary Files — Same machines — Same speeds (or higher). No more, time consuming, "kid-glove" care. Just chuck them up in your regular equipment and watch these RUGGED CARBO-MILLS go to work!

CARBO-MILLS ASK NO SPECIAL FAVORS

3/32" SHANKS
7 Standard Numbers, featuring REAL cutting teeth to remove stock faster over long periods of use—as well after regrinding as when new.

CARBO-MILLS by the ORIGINATOR of Ground-from-the-Solid Mills

IN PORTABLE TOOLS

1/8" SHANKS
12 STANDARD NUMBERS
THE POPULAR WORK BENCH SET

NO PROBLEM OF TOOTH CHIPPING OR BRAZE-FAILURE

CARBO-MILLS PREFERRED BY OPERATORS!

1/4" SHANKS
20 STANDARD NUMBERS

20 Standard Numbers (only 9 illustrated) cover the widest possible range of uses. Don't continue losing valuable time and money; replace your less efficient Rotary Files with these longer lasting, faster cutting, stamina possessing, CARBO-MILLS at the earliest possible moment!

IN MACHINE TOOLS

LAST UP TO 75 TIMES LONGER THAN ROTARY FILES OF HIGH SPEED

REGRINDING — Due to CARBO-MILLS being made of Solid Carbide repeated savings are made possible through successive regrinds.

DIE MAKERS! ASK FOR THIS SET

Furnished to you in a sturdy wooden case, Di-car Set No. 40 is a set of 8, ¼" shank CARBIDE mills designed and instituted specifically for you, the Tool and Die Maker. Specially selected shapes — Special tooth patterns and cuts for all types of precision Tool and Die work. You will ply your skills easier and faster than ever before with these personal finishing mills. These CARBIDE mills need absolutely no coddling and will win their way to the the most favored spot on your Work-Bench! Send for complete information and prices today! Ask for Leaflet No. 645

··· GROUND-from-the-Solid ···

INVESTIGATE NOW!
FOR COMPLETE INFORMATION AND PRICES SEND FOR BULLETIN CM.

SEVERANCE TOOL INDUSTRIES, INC.
730 IOWA ST., SAGINAW, MICH.

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WHO WHAT WHEN WHERE

The old reliable . . . Wm. H. Ottemiller Co., of course.

Precision, milled-from-the-bar Cap Screws, Set Screws, Milled Studs and Coupling Bolts.

Some numbers we can ship immediately—others—well, you know how it is—they'll take a little time.

For special jobs contact us, for catalog items see your local Industrial Distributor.

WM. H. OTTEMILLER CO., YORK, PA.

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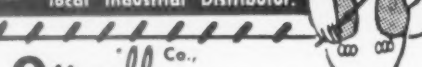
EXTRA LONG LENGTH High Speed Drills



IMMEDIATE DELIVERY!

No. By Gage	Length (Inches)	Our Price Net Each
1—10	6¼	$1.00
11—20	5¾	.90
21—30	5⅜	.80
31—40	5⅛	.70
41—50	4½	.60
51—60	3½	.50

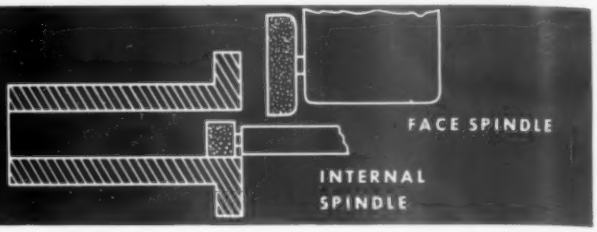
⅛" to ½" H.S. 12" long S.S. Drills; 17/32" to 31/32" H.S. 15" long T.S. Drills; 1" to 1¼" H.S. 20" long T.S. Drills also available.

VICTOR MACHINERY EXCHANGE, INC.
DEALERS IN TOOL ROOM EQUIPMENT
251-D Centre St., New York 13, N. Y. ● Phone CAnal 6-5575

USE READER SERVICE CARD; INDICATE A-1-109-5

GRIND Holes and Faces with ONE Set-Up on FORTUNA SIP Internal and Face Grinders

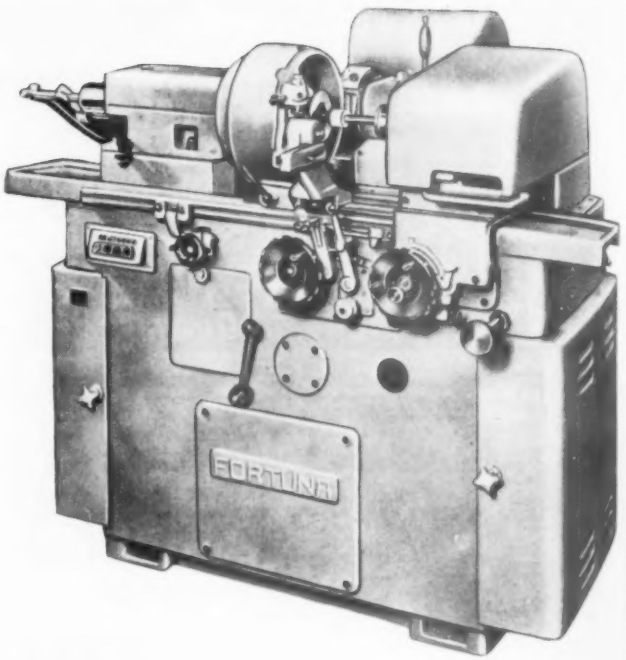
For Production Line or Tool Room Use



Designed for precision grinding at high production speeds the Fortuna SIP has . . .

- Two rigidly constructed Spindle Head Stocks for internal and face grinding operations.
- Hydraulic table movement.
- Hydraulic feed for internal grinding spindle.
- Centralized controls for ease of operation.
- Semi-automatic, cam controlled feed for production grinding, furnished when required.

Important for production or tool room work are the two spindles for grinding holes and faces of the work pieces with the same set-up and for grinding the faces accurately at right angles to the bores.



CAPACITIES AND SPEEDS

	SIP III	SIP IV
Maximum diameter of work piece or chuck	12-1/2"	12-1/2"
Maximum diameter of work piece with collet	7"	10-5/8"
Maximum swing	14"	14"
Maximum grinding depth	7-7/8"	7-7/8"
Minimum grinding diameter	5/16"	15/32"
Maximum table travel	14"	14"
Table speeds, stepless hydraulic regulation—inches per minute	12"-470"	12"-470"
Minimum feed for internal grinding spindle	.00004"	.00004"
4 workpiece speeds	80-435 r.p.m.	70-400 r.p.m.
Hole in work head	7/8"	2-3/8"
Swivel of work head for grinding tapers on work pieces up to 8-1/4" diameter	10°	10°

For complete details send for descriptive literature

COSA CORPORATION
405 Lexington Ave., New York 17

Your source for all Precision Machine Tools— from Small Bench Lathes to Large Boring Mills

IN DETROIT AREA contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich.

A HUNDRED JIGS IN ONE

with CARDINAL SPEED VISE

EXCLUSIVE FEATURES

1. Saves time—one hand operation—"lift, slide, lock!"
2. Saves tooling expense—smaller, simpler jigs.
3. Saves space in tool crib.
4. Indispensable for toolroom work in addition to production.

SOLD ONLY THROUGH RECOGNIZED DISTRIBUTORS.

new literature available

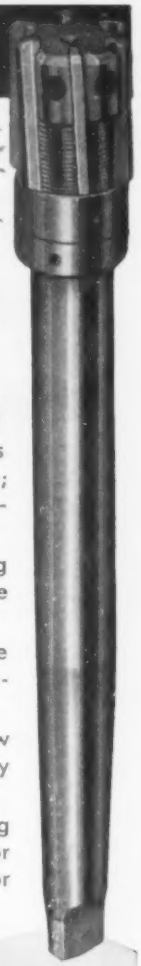
CARDINAL MACHINE COMPANY
GLENDALE, CALIFORNIA

USE READER SERVICE CARD; INDICATE A-1-111-1

MODERNIZE!

Like your safety razor- you only replace the blades in

WAUKESHA *Inserted* BLADE REAMERS



WAUKESHA *Inserted* Blade Reamers are Tops in economy. The Reamer body lasts for years; your only cost is for new blades when replacement is needed.

And WAUKESHA *Inserted* Blades have long lived, high precision cutting edges that give you a clean, smooth and positive sheer.

WAUKESHA *Inserted* Blade Reamers save horsepower, increase production and faithfully give you more holes per grind.

WAUKESHA *Inserted* Blade Reamers are low in their initial cost, too, so you save money right from the start.

WAUKESHA TOOL COMPANY offers Cutting Tools in heavy duty high speed steel or carbide tipped. Standard tools, ready for immediate shipment are,

Long Shank Reamers
Short Shank Reamers
Shell Reamers
Spade Drills
Arbors

But WAUKESHA also has unusual facilities for the manufacture of special tools to meet your individual problems. WAUKESHA Engineers will welcome an opportunity to cooperate.

"in reamer work of every kind WAUKESHA means more holes per grind!"

FREE-This new catalogue of WAUKESHA TOOLS on your request

Complete specifications for all models of WAUKESHA Cutting Tools are given in this new, concise catalogue. It also describes WAUKESHA's manufacturing, engineering and designing facilities. Please send for it today. Use the convenient coupon below if you prefer.

WAUKESHA TOOL CO.
1428 Arcadian Avenue
WAUKESHA, WISCONSIN

WAUKESHA TOOL CO.
1428 ARCADIAN AVE., WAUKESHA, WIS.

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Ready for Immediate Delivery

TWO complete bushing standards, the A.S.A. Standard plus our own Acme Standard, provides a much wider selection, enabling you to obtain bushings from stock that often would require special manufacture. Results in faster delivery, lower cost. Write for catalog.

Accurate Interchangeable Concentric

Acme Industrial Company

Makers of Hardened and Ground Precision Parts

208 N. Laflin Street • Chicago 7, Illinois

THE SERVICE SHOP TO INDUSTRY FOR MORE THAN 25 YEARS

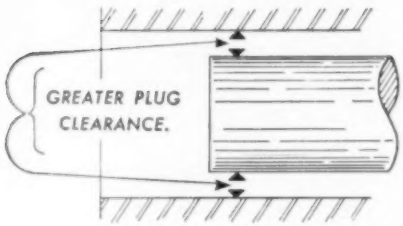
USE SERVICE READER CARD; INDICATE A-1-111-2

LET'S GET IT STRAIGHT!

The "DIMENSIONAIR" Air Gage —

EACH GRADUATION IS .00005"
AND NO DOUBT ABOUT IT.

LONGER PLUG WEAR
because of greater JET clearance.



IS calibrated accurately over its entire range

IS set accurately with only *one* master

HAS a range of .003" with 2500 to 1 magnification

HAS much longer plug wear

HAS greater plug clearance so that the same plug can be used on *both* rough and finished dimension

REMAINS *stable* for long periods of time

YES, LET'S GET IT STRAIGHT, the Dimensionair uses its own operating principle and new mechanical devices which do away with the limitations common to previous types of air gages.

ACTUAL SIZE: 9" x 7⅜" x 8½"
WEIGHT 17¾ LBS.

FEDERAL
DIMENSIONAIR
PROVES ITSELF

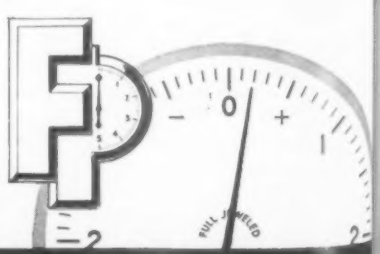
Why not find out to your own satisfaction what the Federal Dimensionair will do for you! Put it to work—discover how the exceptional measuring range of .003" lets you gage irregular shaped and tapered holes. Oil or coolants won't affect the Dimensionair: grit and dirt won't clog it: rough handling won't harm it.

Find out how the Dimensionair can do all this and more—ask our nearest representative to show you the Federal way to better, more positive air gaging, or write to us for complete information and prices.

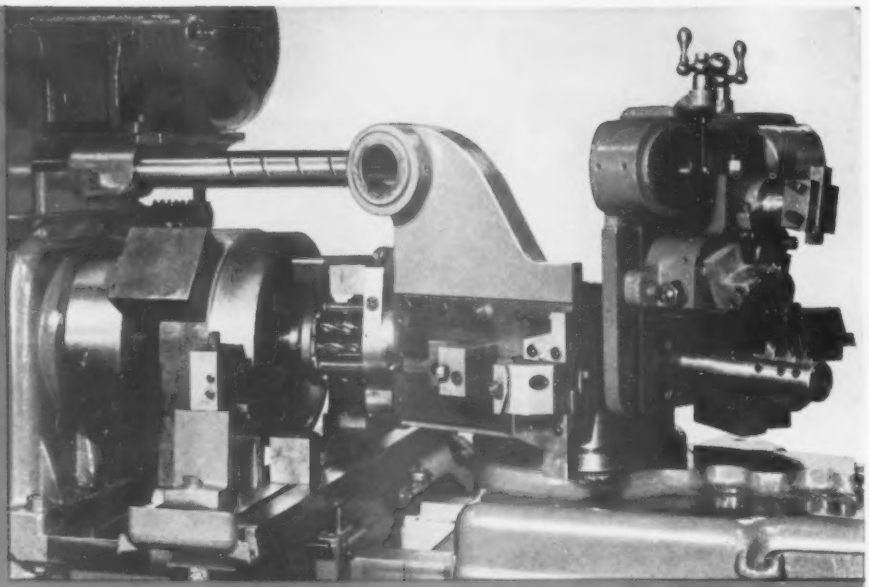
FEDERAL PRODUCTS CORPORATION, 1191 Eddy Street, Providence 1, Rhode Island.

FEDERAL

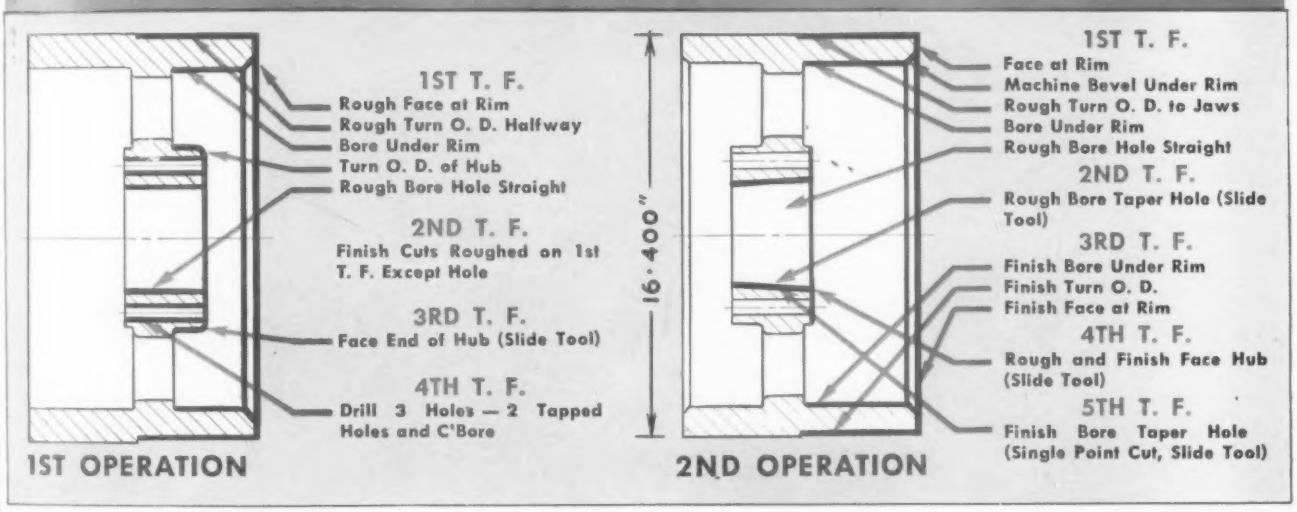
Largest manufacturer devoted exclusively to designing and manufacturing *all types* of DIMENSIONAL INDICATING GAGES



QUALITY CONTROL IN QUANTITY PRODUCTION BEST ACHIEVED WITH P & J CARBIDE TOOLING SET UP ON THE



P & J 5DE AUTOMATIC


1ST T. F.
Rough Face at Rim
Rough Turn O. D. Halfway
Bore Under Rim
Turn O. D. of Hub
Rough Bore Hole Straight
2ND T. F.
Finish Cuts Roughed on 1st T. F. Except Hole
3RD T. F.
Face End of Hub (Slide Tool)
4TH T. F.
Drill 3 Holes — 2 Tapped Holes and C'Bore
1ST OPERATION
16·400"
1ST T. F.
Face at Rim
Machine Bevel Under Rim
Rough Turn O. D. to Jaws
Bore Under Rim
Rough Bore Hole Straight
2ND T. F.
Rough Bore Taper Hole (Slide Tool)
3RD T. F.
Finish Bore Under Rim
Finish Turn O. D.
Finish Face at Rim
4TH T. F.
Rough and Finish Face Hub (Slide Tool)
5TH T. F.
Finish Bore Taper Hole (Single Point Cut, Slide Tool)
2ND OPERATION

You should see it in operation — this typically efficient P&J high-speed method for machining Pulleys on a precision-production basis. The machine best fitted for the job is the P&J 5DE Power-Flex Automatic with its 17 inch swing over the cross-slide. The Tooling on its 5 turret faces and cross-slide consists mainly of P&J's *standard* turret tool units, augmented by P&J-designed slide tools for machining the hub ends and taper hole, and a P&J-designed multiple spindle drill head which is aligned automatically for the proper position of the 5 holes in the hub and which rotates with the work. The cycle of operations is fast and fully automatic . . . results in faster and better machining . . . to closer limits of accuracy . . . with fewer rejects . . . at a highly profitable rate of production.

MORE THAN FIFTY YEAR'S EXPERIENCE DESIGNING PROFITABLE PRODUCTION TOOLING FOR P & J AUTOMATICS

POTTER & JOHNSTON CO.

Subsidiary of PRATT & WHITNEY
Division NILES-BEMENT-POND COMPANY
PAWTUCKET, RHODE ISLAND, U. S. A.

Precision Production Tooling for 53 years

P&J

PARKER • MAJESTIC pm PRECISION MACHINES

Above is pictured the home and products of the

PARKER-MAJESTIC, INC.

For over twenty-one years this company has manufactured the Parker Spindles used in Precision Grinding, Boring and Milling applications.

Supplementary products include the well known line of Parker-Majestic Internal, External, No. 2 Surface and Rotary Surface Grinders.

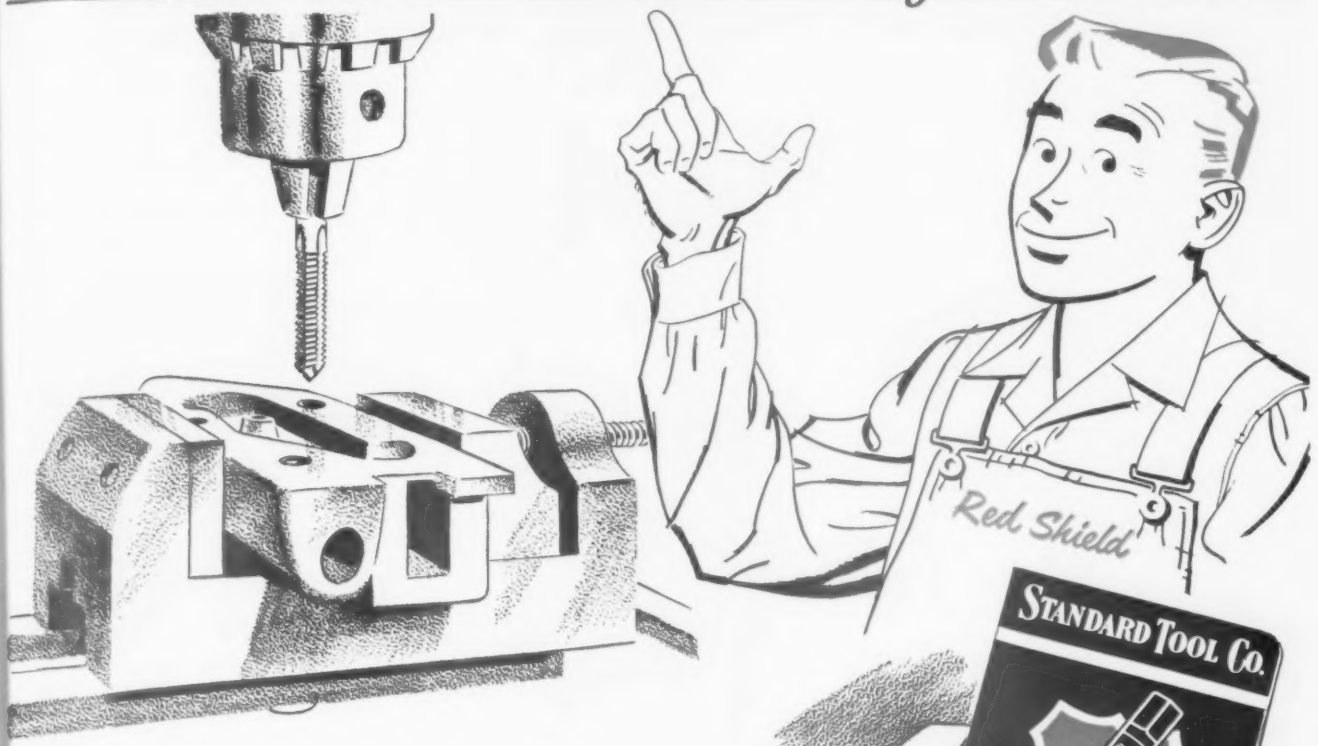
Descriptive literature upon request.

PARKER-MAJESTIC, INC.

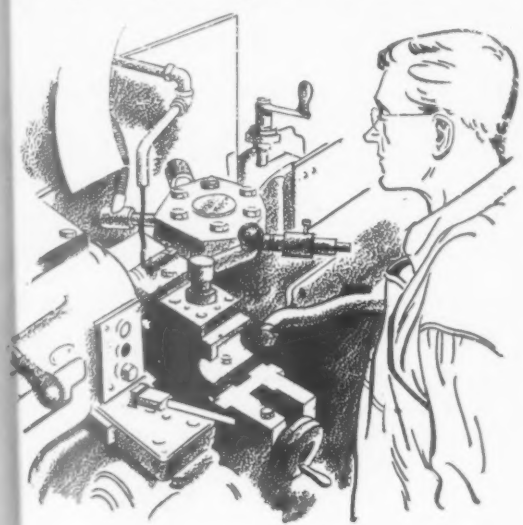
formerly MAJESTIC TOOL & MFG. CO.

147 JOS. CAMPAU • DETROIT 7, MICHIGAN

TAPPING POINTERS..... by Red Shield



ALUMINUM. Using 8×32 special gun flute taps. Through holes. We suggested 8×32 commercial-ground, four-fluted machine screw taps with special surface treatment. Cut original tool cost and greatly lengthened life of taps.



SERVICE. The local distributor of Standard Tool Co. products will see that you get the help of our Red Shield Service Staff to help on your metal cutting problems. Write for free booklet, "TAPPING DATA".

ALLOY STEEL. Using regular cut thread taps on turret lathe. Through holes. We recommended high-speed, commercial-ground spiral point plug taps with special surface treatment. Also showed them how to sharpen taps. Result: 500 to 1,000 more pieces per grind.

STANDARD TOOL CO. DEPT. 2-F, 3950 CHESTER AVENUE CLEVELAND 14, OHIO

New York • Detroit • Chicago • San Francisco

THE STANDARD LINE: *Drills • Reamers • Taps • Dies • Milling Cutters • End Mills • Hobs • Counterbores • Special Tools*

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Tool steel is our baby. It has been for 52 years. It always will be. That's why tool steel users look with confidence to Crucible.

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Peerless Hot Work Steels
Halcomb 218
Chro-Mow®
Sanderson Carbon Tool Steels
Ketos®
Airkool Die Steel
Airdi® 150
Nu-Die V Die Casting Steel
CSM 2 Mold Steel
La Belle® Silicon #2
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SPECIFY YOUR TOOL STEELS BY THESE BRAND NAMES

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9" diameter, 3-colors

CRUCIBLE first name in special purpose steels

52 years of Fine steelmaking

TOOL STEELS

FREE Cylinder Catalog and Templates offered by Ortman-Miller Co.

Book outlines several special features of O-M cylinders.

FREE

A new, 28 page catalog has just been released by the Ortman-Miller Machine Co. which gives complete engineering specifications, data on O-M's special internal locking system and special full listing of O-M parts. Prepared for designers and users of cylinders for any application, it covers standard, oversize and 2-1 piston rods, giving full information on all sizes from 1½" to 8" bores.

SPECIAL FEATURES

Included are detailed explanations of the many features which have made ORTMAN-MILLER cylinders standard in thousands of plants throughout the country. Detailed drawings and copy explain the special shear bar assembly which completely eliminates bulky end caps and tie rods, thus saving up to ⅓ in space. In addition, it shows the vast number of interchangeable mountings and applications which almost always eliminate the need for special castings or patterns. This feature alone not only saves initial costs, but cuts down on inventory and greatly speeds up delivery on every order.

Special Note:

30 DAY DELIVERY

Increased production facilities and standardization of parts continue to make possible delivery in 30 days or less on almost all orders for O-M cylinders. Write today for details.

FREE TEMPLATES

In addition to the FREE catalog, Ortman-Miller also leads the field in making available FREE TEMPLATES of all O-M cylinders. Prepared in half scale, they are extremely useful in design and application of O-M cylinders to your special requirements.

For your FREE Catalog or templates, use the coupon in the ad at the right. Or write to ORTMAN-MILLER Machine Co., 1216 150th St., Hammond, Indiana.

4 REASONS WHY

YOU SHOULD USE O-M AIR, WATER & HYDRAULIC CYLINDERS

1 30 DAY DELIVERY

Complete standardization of interchangeable parts and elimination of need for special patterns and castings mean faster production, lower costs. Even the most difficult "custom" applications can almost always be made from O-M standard cylinders . . . without delay!

2 NO TIE-RODS, BOLTS or SCREWS!

New simplified design completely eliminates bulky end caps and tie rods, saves up to ⅓ in space. No bolts or screws. Special circumferential keys allow quick, easy installation, even faster repacking.

3 MACHINED STEEL, NO CASTINGS

All cylinder body parts are bar stock steel, made in automatic screw machines. No castings whatsoever. All bearing surfaces are bronze.

4 SAVE SPACE, TIME AND MONEY

O-M special features mean less inventory . . . increased uses from standard sizes. Interchangeable mounting brackets, ports adjustable to any angle. Full range of sizes from 1½" to 8" bores.

FULL DETAILS IN COLUMN AT LEFT

FREE!

NEW CATALOG
Gives full details, data and specifications on all O-M cylinders. Standard, oversize & 2-1 piston rods.

TEMPLATES
Complete set of ½ scale templates showing all cylinders and mounting brackets.

ORTMAN MILLER MACHINE CO.
1216 150TH ST.
HAMMOND, INDIANA

Ortman Miller Machine Co.
1216 150th St., Hammond, Indiana

Please send me ___FREE CATALOG of O-M cylinders
___FREE SET of templates

Name _____ Position _____

Company _____

Address _____

City _____ Zone ___ State _____

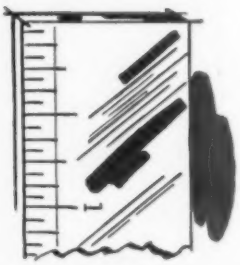
THE EVOLUTION

THIS INCH IS 1⅜ INCHES

It met requirements in the time of the English King Henry VII.

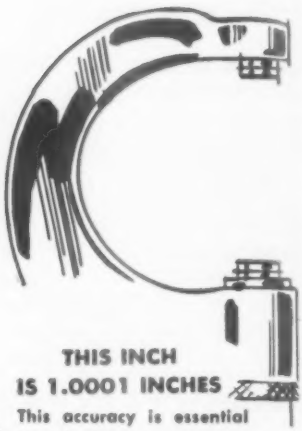
THIS INCH IS 1/16 INCHES

It is suitable for measuring the length of trousers and shirt sleeves.



THIS INCH IS 1.05 INCHES

It is suitable for carpentry work and similar measurements.

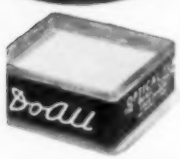


THIS INCH IS 1.0001 INCHES

This accuracy is essential for checking a precision part which must be accurate to .001 inch.

DoALL BLOCKS—a complete line from a 118-piece master set to a 6-piece set for checking micrometers. Accuracies to ±.000002".

DoALL ELECTRIC COMPARATOR—for directly checking dimensions of parts, tools and gages for tolerances as small as ±.000001"; its four gaging ranges take place of four separate comparators.

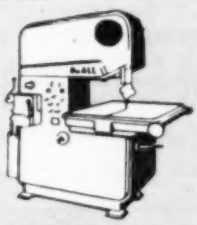


DoALL Fused Quartz OPTICAL FLATS—for use under a Monolite to "read" millionths-of-an-inch variations in dimensions or surfaces. Round and square types; accuracies to ±.000001"; sizes to 14" diameter.

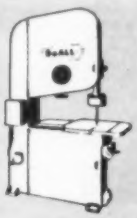
NEW DoALL MONOLITE—six inch high intensity helium light source covers 14 square inch area; millionths-of-an-inch variations in flatness, parallelism and size detectable when viewed through optical flats under this light.

DoALL MOBILE INSPECTION UNIT—with this unit you check all gages at their point-of-use in the shop. Convenient, practical, time-saving, it is part of the DoALL Quality Control System.

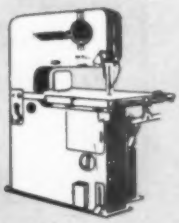
GB-6



CONTOUR-MATIC



ZEPHYR



CONTOUR

BAND FILER

SAW BAND

OF THE INCH

THIS INCH IS 1.000002 INCHES

It is the length of 86206.9 helium light wavelengths. This DoALL BLOCK is a *master standard* for checking less accurate gages and for dimensional comparison studies.

THE INCH YOU CAN "SEE" THROUGH THIS DoALL INTERFEROMETER IS 1.000000 INCHES

Here is direct measurement with light wavelengths accurate to six decimal places or more —the ultimate and unvarying linear constant against which your gage blocks must be periodically inspected and calibrated in order to insure their accuracy. Today DoALL is using Mercury isotope 198 as a monochromatic light source to check gage blocks sent in for calibration.

DoALL Offers You a UNIVERSAL INCH Based on the Constancy of a Light Wavelength — to Reduce WASTE of Manhours, Metals and Money

ONCE, men used their thumbs for a measurement standard. Today, as illustrated by the above graphic portrayal of the evolution of the inch, even thousandths accuracy is crude for purposes of control. Remember—to insure accuracy a gage must be ten times more accurate than the part or other gage it is checking.

Think a minute—how accurate are your gages? Are you using the same inch throughout your plant? Is it the same inch other plants are using to produce parts which must mate or interchange with those you produce? Not a single one of your precision gages or instruments is reliable unless calibrated against the standard inch.

DoALL Blocks and accessories, themselves calibrated against light wavelengths, provide the means for calibrating all of your other gages, thereby assuring dimensional control that can eliminate rejects and waste caused by failure to meet exacting tolerances. They are also used for direct checking of parts—thousands of fixed gages can be made up quickly with DoALL Blocks and accessories.

DoALL gaging equipment is available to meet the needs of *every* plant. Ask about the DoALL *Dimensional Quality Control System* which includes gages, accessories, demonstrations, explanatory texts and periodic gage block calibration service. Call your local DoALL Sales-Service Store or write direct to

THE DoALL COMPANY
254 N. Laurel Ave., Des Plaines, Illinois
35 Sales-Service Stores in the United States, Canada and Mexico

SEND FOR NEW 24-PAGE CATALOG "MODERN MEASUREMENT" CONTROL

This catalog explains the need for DoALL Blocks; shows typical uses; gives the ten big reasons you can trust DoALL Blocks; describes the complete line of sets, accessories, complete inspection laboratories and related equipment. For your copy call your local DoALL Sales-Service Store or write to DoALL.

DoALL®

TOOLROOM GRINDER

CRUSH GRINDER

GAGING EQUIPMENT

MONOLITE

MOBILE INSPECTION UNITS

TOOL STEEL

R AND L *Tools*

R AND L PRECISION TOOLS FOR AUTOMATIC AND HAND SCREW MACHINES

When the R and L Turning Tool was introduced to screw machine men in 1936, it was quickly recognized for what is—a well engineered tool with FOURTEEN TURRET TURNING APPLICATIONS that could reduce both tooling costs and tool inventories without sacrificing quality production.

Succeeding years have proven the value of this multi-purpose design and since then other tools, listed below, have been added to the line for application to all classes of work and to a wide range of machines. In many shops they are considered to be the standards.

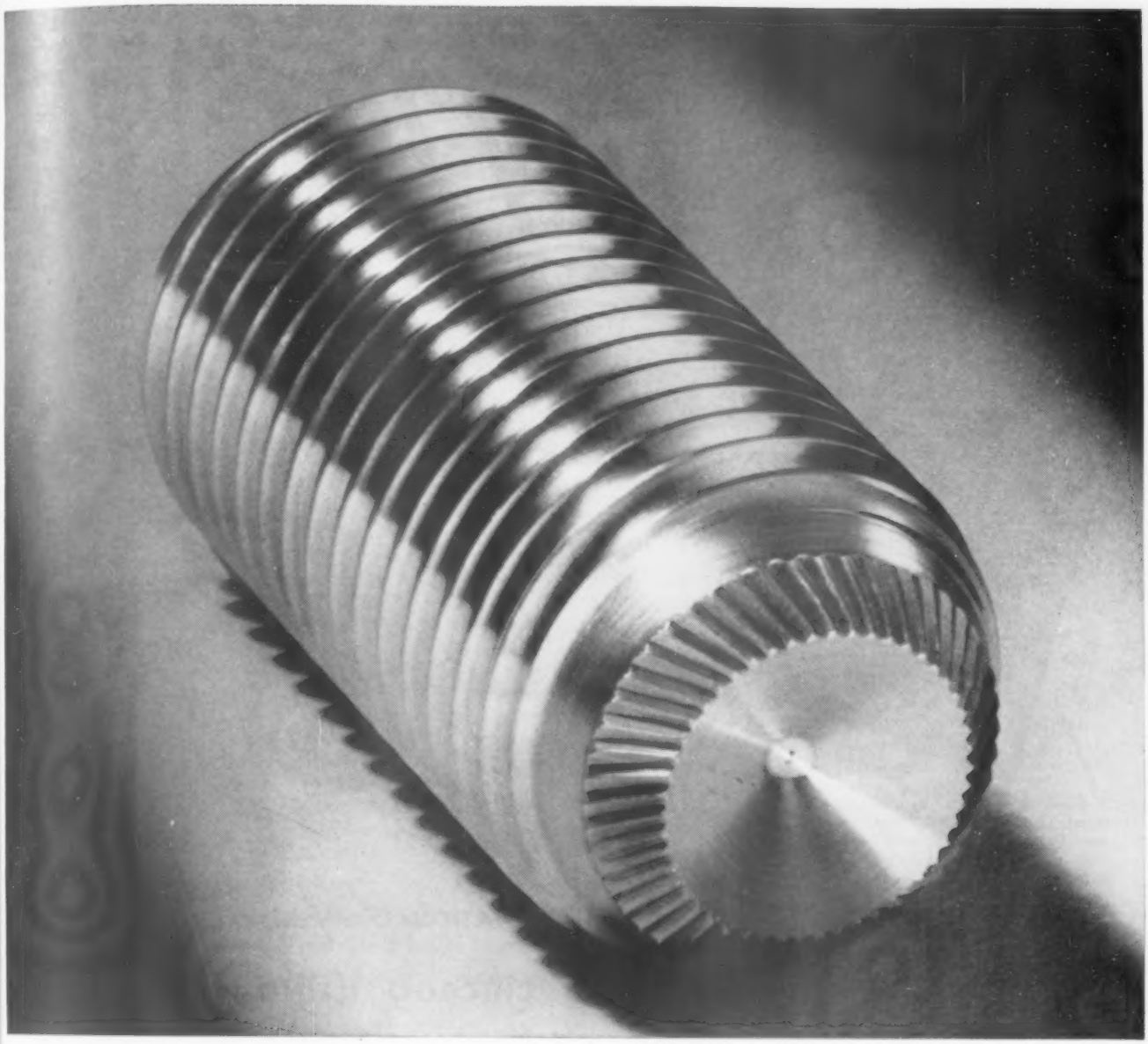
Today R and L Tools stand a major manufacturer of quality screw machine tools, capable of supplying most of your requirements in tools ranging from $\frac{5}{8}$ inch shanks to $1\frac{1}{2}$ inch diameter shanks.

Send for our 28 page catalog-T showing specifications and current prices and learn what the R and L Line can do for you.

R AND L TOOLS

1825 BRISTOL STREET
PHILADELPHIA 40, PA.

TURNING TOOL — TAP AND DIE HOLDER — UNIVERSAL TOOL POST — TURRET BACKREST HOLDER — CUT-OFF BLADE HOLDER — RECESSING TOOL
RELEASING ACORN DIE HOLDER — REVOLVING STOCK STOP — FLOATING DRILL HOLDER — KNURLING TOOL — CARBIDE AND ROLLER BACKREST



SELF-LOCKING SOCKET SET SCREWS

ORIGINATED BY UNBRAKO®

. . . the screws that won't work loose

Unique counterclockwise knurls make these UNBRAKO Set Screws self lockers, prevent creep and subsequent loosening. Because UNBRAKO Self-Locking Set Screws stay tight, even in poorly tapped holes, they reduce maintenance costs and production losses. Write for descriptive literature. STANDARD PRESSED STEEL Co., Jenkintown 37, Pennsylvania.

SPS recommends STANDARDS — #4 to 1" available in UNBRAKO distributors' stocks.

Ask your UNBRAKO distributor about deliveries. You'll be pleasantly surprised. Even in the larger sizes, you'll find deliveries of UNBRAKO Screws are good.

SPS

UNBRAKO SOCKET SCREW DIVISION

JENKINTOWN PENNSYLVANIA

In Chicago you can find
THE ANSWERS TO QUESTIONS LIKE THESE:

Fastest way to learn

- **Have there been major improvements in production equipment recently?** *(There certainly have. A visit to the Exposition will convince you.)*
- **Can we substitute faster processes to increase productivity, lower costs?**
- **What about 'quality control'?** *(An entire hall devoted to quality control exhibits.)*
- **What about foreign machine tools? What is available?**
- **What about metal forming? Any new developments?**
- **Is there any way of reducing down-time on machines?**
- **How about cutting tools? Is there anything new?** *(We can assure you "there is.")*
- **What about devices to increase machine productivity?** *(You'll find hundreds of them.)*
- **How can accuracy be increased in machining operations?**
- **How about easier and simpler tool changes?**
- **More versatile accessories and controls?**
- **How can machine speeds be boosted effectively?**
- **What about simpler machine controls?**
- **Can we get BOTH increased productivity and lower cost?** *(You CAN—and the 1952 ASTE Exposition will be a big help both ways.)*

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Five huge halls of exhibit space with hundreds of exhibits devoted exclusively to what is vital, what is new in the way of production equipment

plus

. . . technical sessions and forums at which outstanding production problems will be fully aired.

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March 18—
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Get your ticket today. Make your reservations now. Write or wire for *your* advance registration blank.

AMERICAN SOCIETY OF TOOL ENGINEERS
10700 PURITAN AVENUE **DETROIT 21, MICHIGAN**

POSITIVE VISIBLE CONTROL *The NILCO WAY*

COMPARATOR DIAL SNAP GAGE

Enables inspector to use both hands for checking. Note that the weight of part rests on solid anvil.

DIAL SNAP GAGE AND MASTER WITH STAND

Correct readings are obtained at once as the gages are applied on the work. There is no need of rocking back and forth, so often required in ordinary dial snap gages. This speeds the operation of turning or grinding when it is important to know how much is left on the diameter; .0001 indicator quickly reflects the size to the operator on the gage, giving control, confidence, and speed to the operator.

LARGE SIZE SNAP GAGE

Even for large diameters, gage is light, compact, easy to handle. Will repeat. Nilco dial snap gages make possible close shoulder checking, radius guides applicable on request.

LARGE DIAL BORE GAGES

Checking internal diameter quickly, easily; simple setting to gage blocks or master ring No skill needed for setting or checking. Compactness and simplicity of design make possible five models in standard or pistol grip design from 1" to 12".

THE FASTEST, MOST ACCURATE MODERN METHOD TO CHECK INTERNAL GROOVE DIAMETERS

The Nilco Dial Groove Gage is a self-positioning precision instrument especially designed to provide POSITIVE CONTROL in checking diameters of internal grooves and recesses, Truarc and "O" rings, oil grooves, washer grooves, etc. Because of its unique design and patented features the Nilco Dial Groove Gage can be used efficiently by both skilled and unskilled personnel in maintaining quality control and inspection throughout production.

Setting can be made direct to master ring gage, a gage block combination, or micrometer.

Illustrations and literature are available on this gage and also on the companion dial groove location gage for checking internal groove locations.

SMALL DIAL BORE GAGES

This fastest setting dial bore gage provides the operator control on small bores in graduations of .0001". Three models cover the range from 3/8" to 1".

Also, all types of dial snap gages, dial bore gage, internal and external dial spline gages for checking pitch diameter of gears and splines. New NILCO DIAL GROOVE LOCATION GAGE, AGD plain plug and ring gages.

ENGINEERS

NILCO

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IN GAGES

NILSSON GAGE CO., INC. POUGHKEEPSIE, N. Y.

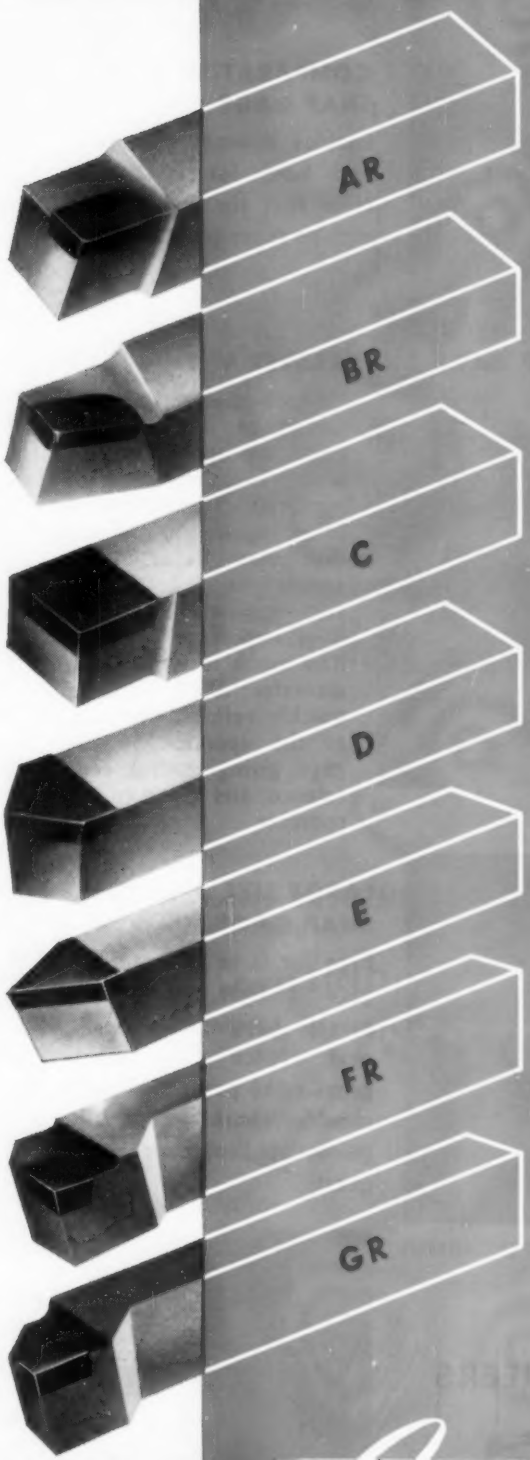
STC

FOR TURNING • FACING • THREADING • BORING

Super

STANDARD TOOLS

NOW IN STOCK CARBIDE TIPPED WITH CARBOLOY-KENNAMETAL and available with other leading carbides



Get the benefit of Super's tool making skill and still use the carbide you like.

Send for Supplement No. 5 for net prices and full particulars.

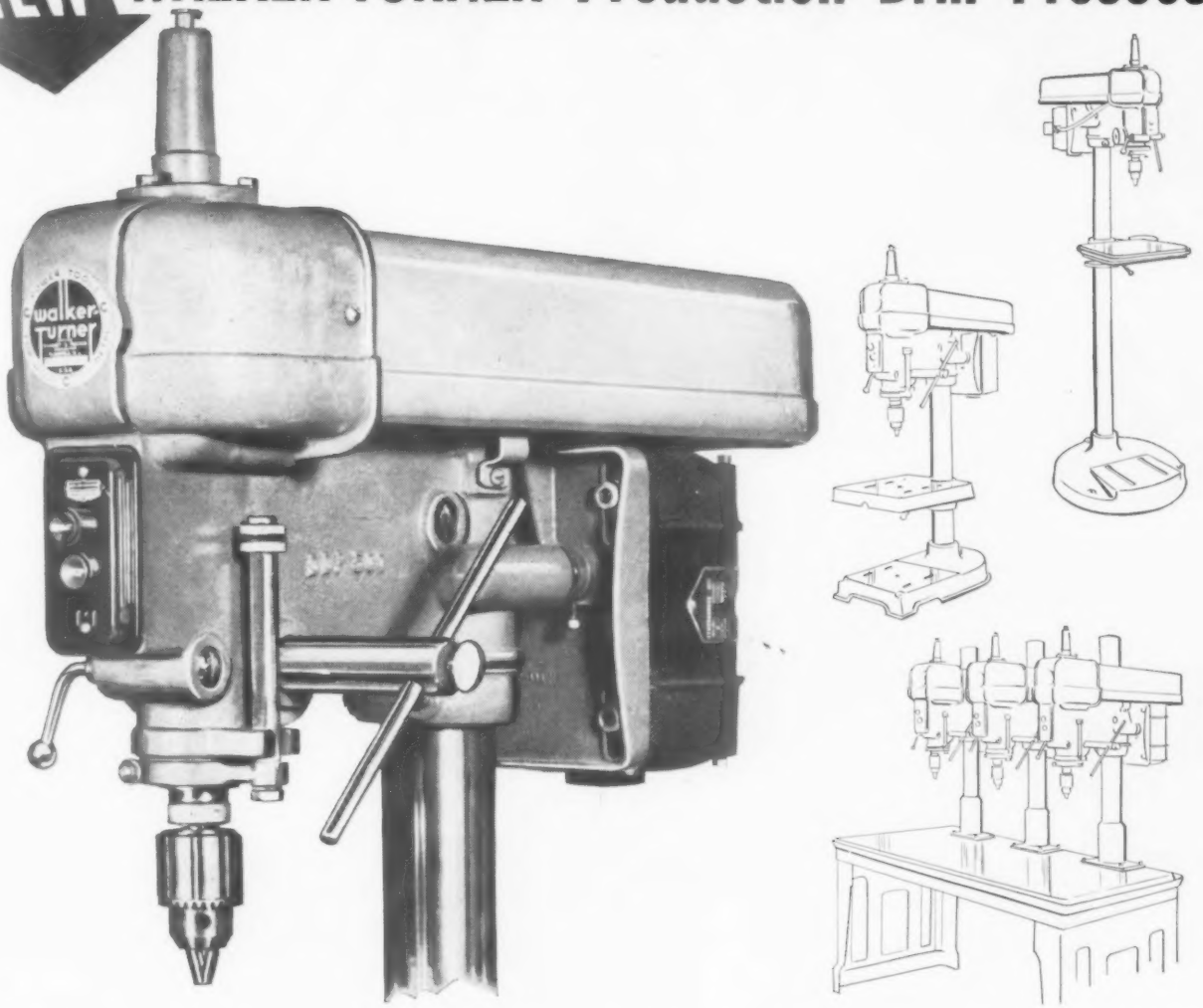
QUALITY CARBIDE TOOLS SINCE 1927

Super TOOL COMPANY

21650 Hoover Rd., Detroit 13, Michigan • 5210 San Fernando Rd., Glendale 3, California

For Faster, more efficient production

NEW WALKER-TURNER Production Drill Presses



If you saw these machines in operation at the Metal Show . . . talked with any of our representatives there, then you know there's more to Walker-Turner *design* than meets the eye.

Clean and modern in appearance, the new Walker-Turner Production Drill Presses are designed for fast, accurate drilling. With heads adaptable to hundreds of diversified uses, and a wide range of speeds, they may provide a low-cost solution to your production problem. 72 different models!

See the complete line at your Walker-Turner Distributor's. Or mail coupon for complete information.

General Specifications

SPINDLE TRAVEL: 4″ or 6″.
FOUR SPEEDS: 600, 1250, 2440 and 5000 R.P.M. using a 1740 R.P.M. motor.
CAPACITY: Bench Models — 12″ chuck to table, 17½″ chuck to base. Floor Models — 39⅝″ chuck to table, 46″ chuck to base. All models 7½″ center of chuck to column. Drills to center of 15″ circle.
CHUCK: #6A Jacobs key type capacity 0 to ½″ on production models.
TABLE: 10″ x 12¼″ machined working area.
BASE: 10″ x 9″ machined working area on Bench Models. 11″ x 9″ machined working area on Floor Models.
SPINDLE: Six spline full floating type, ⅝″ diameter, male #33 Jacobs taper for No. 6A Jacobs Chuck, or #1 Morse taper socket (optional).
PULLEY: Straddle mounted on two ball bearings for extra rigidity. New upper mounting permits quick belt changing.
COLUMN: Ground seamless steel tubing, 2¾″ in diameter.

DRILL PRESSES • RADIAL DRILLS • TILTING ARBOR SAWS • BELT and DISC SURFACERS • METAL-CUTTING BAND SAWS • SPINDLE SHAPERS • JOINTERS

SOLD ONLY THROUGH AUTHORIZED DISTRIBUTORS

WALKER-TURNER
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KEARNEY AND TRECKER CORPORATION
PLAINFIELD, N. J.

WALKER-TURNER DIVISION
Kearney & Trecker Corp., Dept. T-1, Plainfield, N. J.

Please send complete information on new Walker-Turner Drill Presses

Name .....
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City ..... Zone ..... State .....

MORSE
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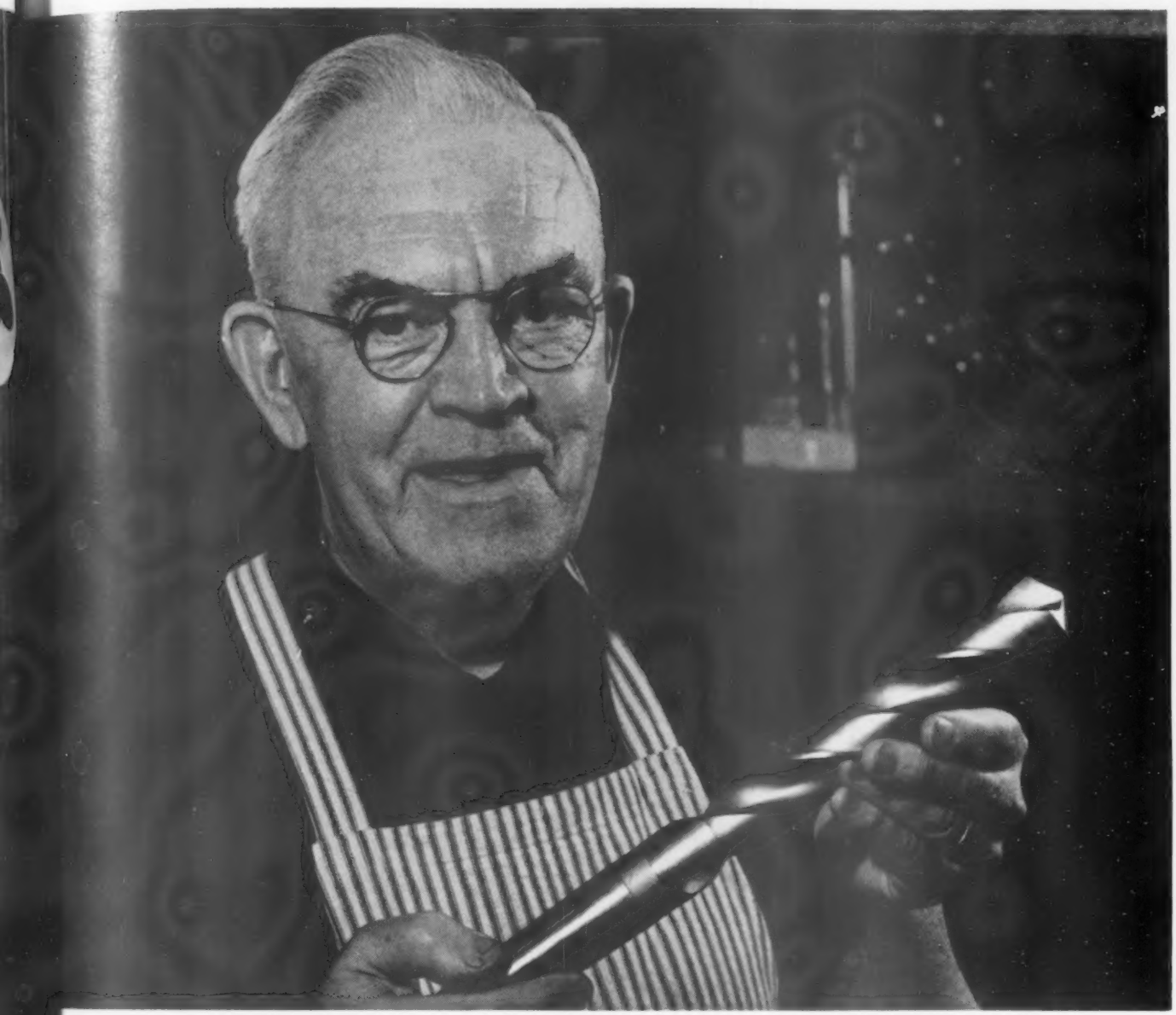
"That's right . . .
for 50 years, man
and boy, we've
used everything
MORSE makes!"



Yes, that's *right!* Ask the tool-crib men in the top precision plants . . . . and count the times you get this same answer:-

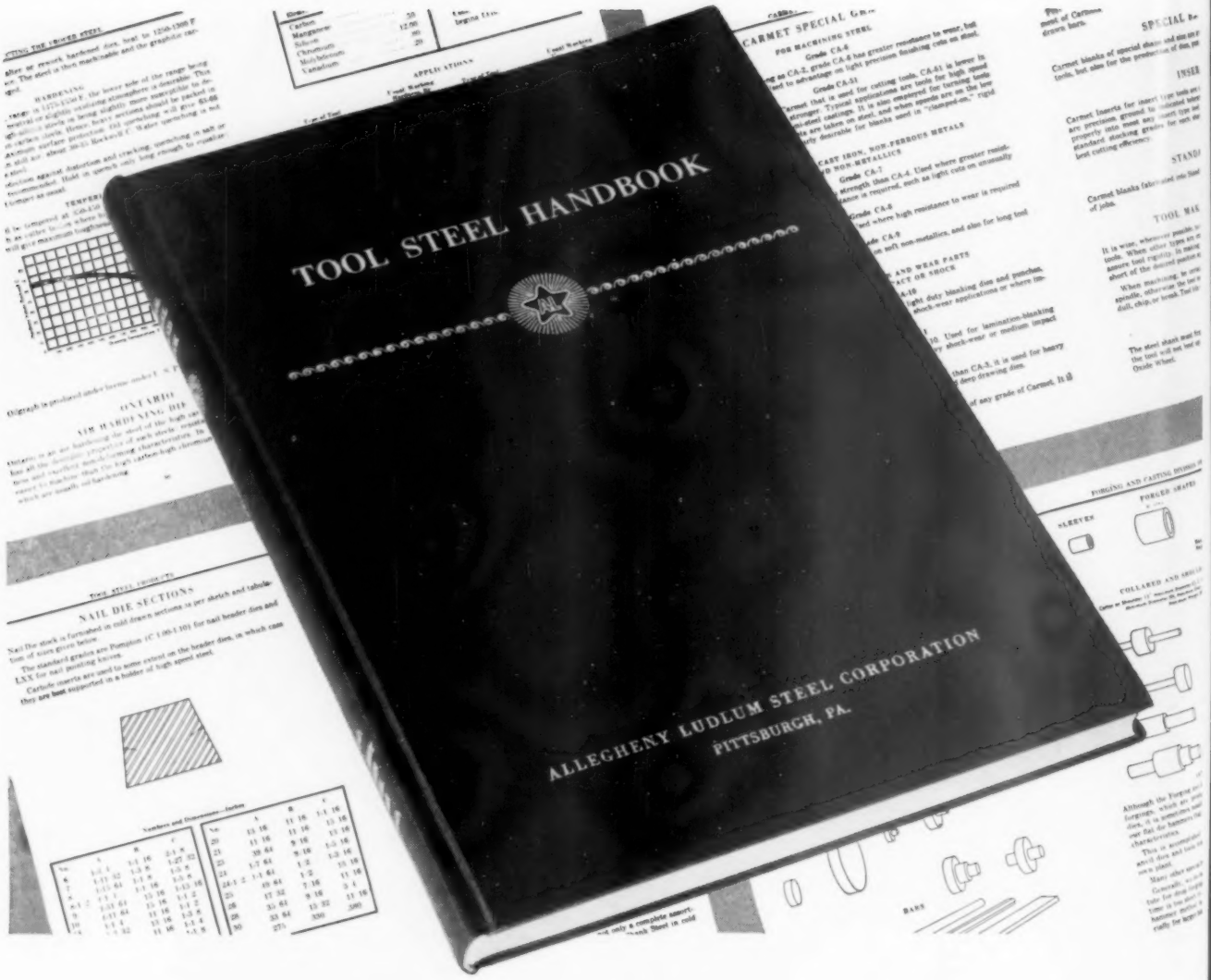
"Sure, Morse makes everything we need in the way of cutting tools, and makes the best that *can* be made. That goes for drills, taps, dies, reamers, end mills, counterbores, countersinks, and milling cutters. So whatever we run into, we know we've got the cutting tools that will give us the same top performance on every job."

And *that's* for sure . . . if you want Morse Quality, then you've got to be sure to get genuine Morse Tools. Ask your Morse-Franchised Distributor . . . he's got the know-how *and the Morse stock* to give you the Morse Tools you need for any cutting job.

Morse Twist Drill & Machine Company
NEW BEDFORD, MASS.
(Div. of VAN NORMAN CO.)
Warehouses in New York, Chicago, Detroit, Houston, San Francisco

MORSE

Cutting Tools



AVAILABLE NOW—196 pages of Valuable Tool Steel Information

A new Tool Steel Handbook—one of the most comprehensive treatises of its kind ever offered by a tool steel producer—has just been published by Allegheny Ludlum. In addition to a relatively complete picture of Allegheny Ludlum Tool Steels, their properties, applications and the forms in which they are available, this 196-page case-bound book presents an extensive discussion of heat treating and handling techniques as well as a complete set of weight tables and other useful reference material.

Your copy of the Tool Steel Handbook will be sent—*without charge*—upon request. Our only stipulation: please make your request upon your company letterhead. • Write Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa.

ADDRESS DEPT. TE-25

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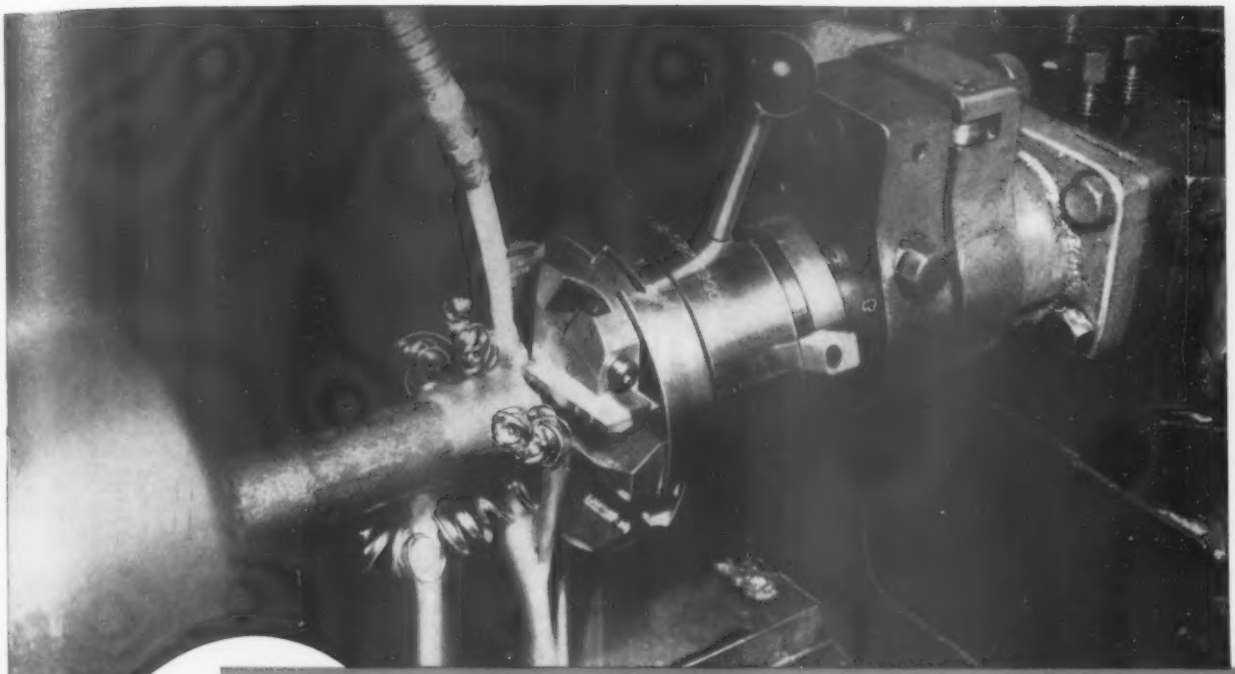
Remember this also
America must have more Scrap to make more Steel!
Get in the Scrap Now!

For complete **MODERN** Tooling, call
Allegheny Ludlum

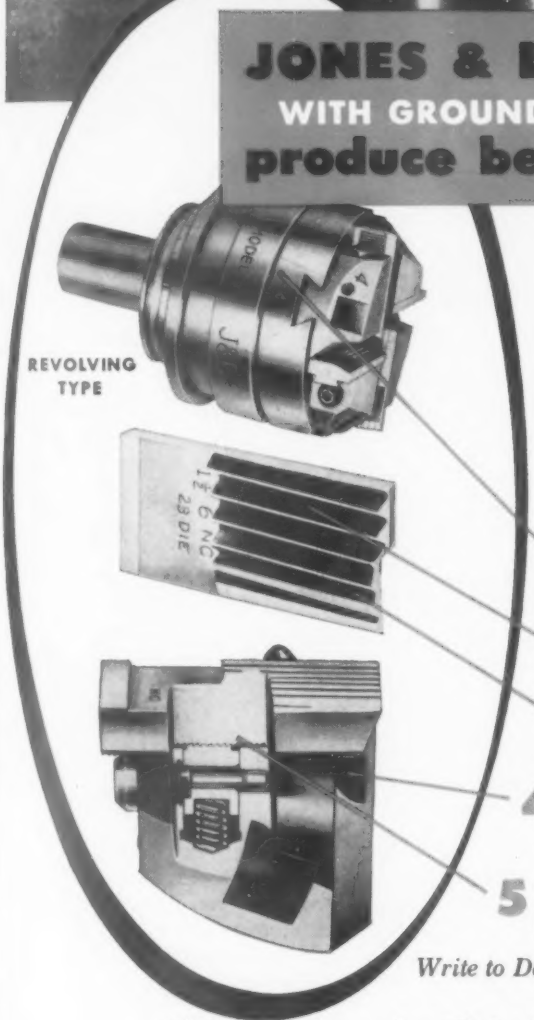
AL FINE TOOL STEELS SINCE 1854



JONES & LAMSON DIE HEADS

WITH GROUND THREAD TANGENT CHASERS

produce better threads at lower cost!



J&L Tangent Chaser Die Heads are rugged, dependable, time-tested tools. They are production engineered to produce better threads at speeds limited only by the material being threaded. Capacities are from #4 to 2″.

There is a J&L Tangent Chaser Die Head engineered for your requirement. Stationary types are available for turret lathes or any machine where the tool does not turn. Revolving types are for automatic screw machines, drill presses, threading machines, or any machine where the tool is held in a live spindle.

Among the many features contributing to their ability to perform your threading job faster and better are these:

1. They are hardened and ground throughout. The chaser holding blocks are precision lapped for perfect fit into the dovetail slots in the body. Chaser cutting edges are held to a minimum distance from the die body.
2. Chasers are guaranteed to produce threads to Class #3 fit or better.
3. Exact helix angle is ground into the chasers after hardening. The result is a freer cutting tool—operating with a minimum of friction, heat and wear.
4. With a single set of chaser holders any standard thread within the rated capacity of the holders can be cut, regardless of helix angle. This eliminates the expense and trouble of constantly changing holders for different helix angles.
5. Chasers are changed and set quickly and easily, giving you more production hours each day.

Write to Dept. 710 for catalog.

Die Head Division

JONES & LAMSON

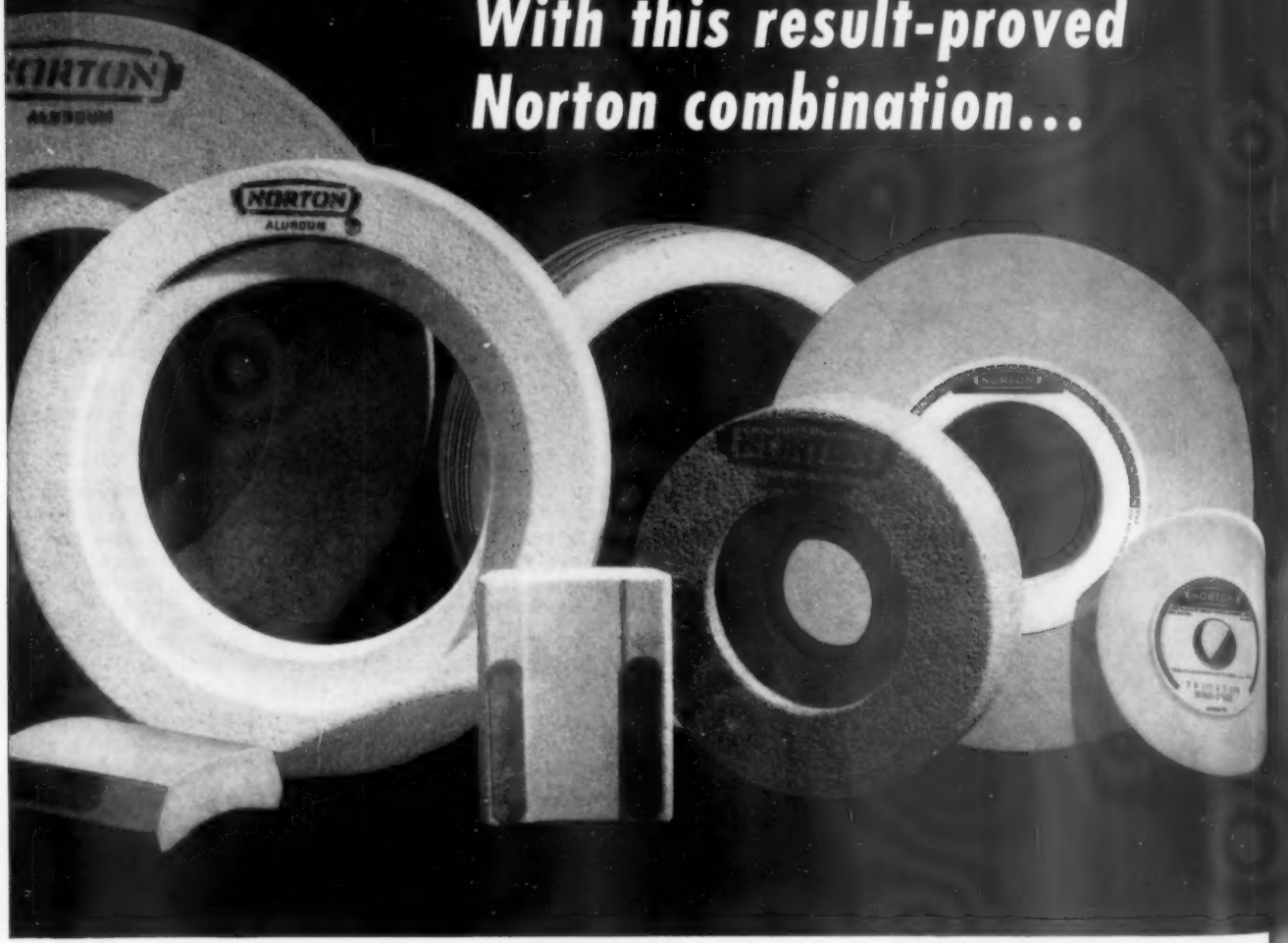
MACHINE COMPANY
Springfield, Vermont, U.S.A.

Machine Tool Craftsmen Since 1835

YOU'LL GET

More Efficient Surface Grinding at Lower Cost

With this result-proved Norton combination...



Best In Abrasives. For every surface grinding job in your plant, there's a type of Norton abrasive — ALUNDUM* (fused alumina) or CRYSTOLON* (silicon carbide) — with the exact cutting characteristics you need for fast, cool, accurate grinding and extra long wheel life.

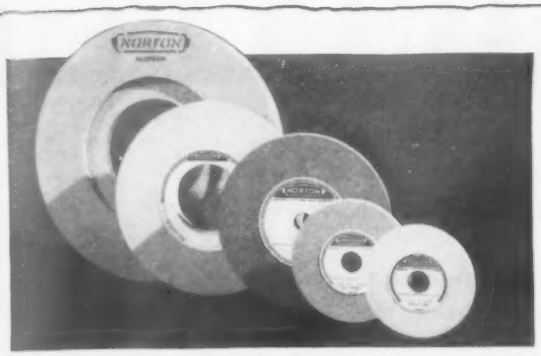
Best In Bonds. Norton bonds for surface grinding include vitrified, silicate, and resinoid. The famous BE vitrified bond is the favorite for about 90% of all surface grinding of steel parts. The others are available for unusual jobs.

Manufacturing Know-How. The skill and precision with which Norton wheels are mixed, molded, and burned are the results of 65 years of steady development — and of constant research. Result: new standards of wheel uniformity and balance which give smoothness and freedom from chatter unmatched in the abrasive industry.

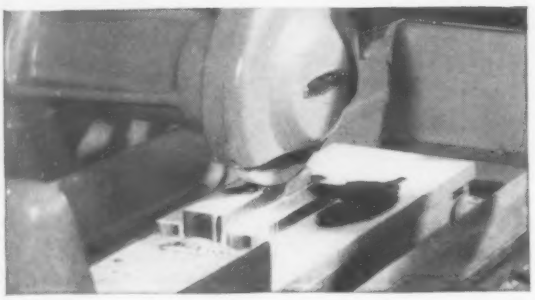
Expert Application. See your Norton Distributor for prompt aid in selecting the *right* wheels, cylinders or segments. If your problems are unusual, he'll call in a Norton Abrasive Engineer. And remember to get your copy of the brand new Norton book, "The A.B.C. of Surface Grinding."

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

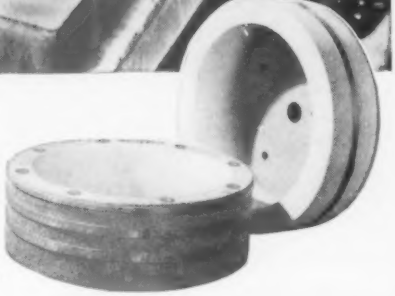
With Norton Products—Applied by Norton Experts—You're Sure of Best Results!

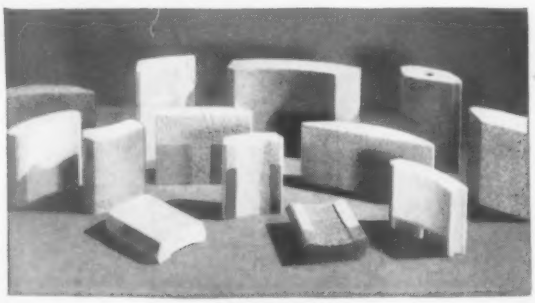


Straight Wheels

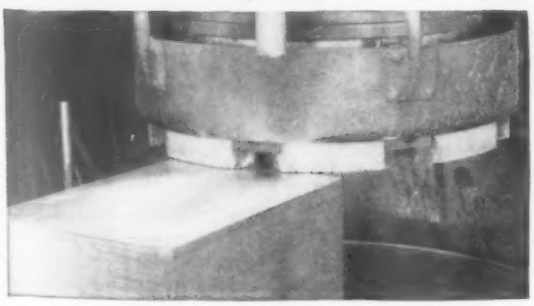


Cylinders





Segments



Another Norton Production-Booster

A Norton chuck with Norton segments can increase output and lower costs on many vertical spindle surfacing jobs where contact is broad. Light and simple in construction, it takes the place of cylinder and back plate, can be mounted without machine alterations — and segments can be changed or adjusted without removal of chuck. Produces a faster, cooler cut and saves valuable time.

NORTON COMPANY, WORCESTER 6, MASS.
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NORTON ABRASIVES *Making better products to make other products better*

BOYAR-SCHULTZ TOOLROOM GRINDERS

Wherever Boyar-Schultz Grinders have been installed, their design, quality of materials and unexcelled workmanship are quickly recognized.

In shops where accurate, close tolerance work is necessary, skilled mechanics turn instinctively to Boyar-Schultz Grinders, knowing that these tools give fullest expression to their ability.

With Boyar-Schultz Grinders in your shop or tool room, you are sure you have the best your tool dollar can buy.

Write for circulars.

No. 6-12 SURFACE GRINDER

A precision Machine Tool built to provide the close tolerance performance that has long been associated only with larger, costlier grinders. Users say that Boyar-Schultz No. 6-12 Surface Grinder produces flatness, horizontal and vertical tolerances comparing with other grinders regardless of size.

No. 2 PROFILE GRINDER

A Profile Grinder for larger and heavier work. Made in two styles—Single or Dual Spindle. Designed for such heavy work as aircraft, automotive and locomotive building, and other heavy profile grinding.

No. 1 PROFILE GRINDER

A fast operating precision Machine Tool for saving time in grinding odd and irregularly shaped surfaces; fitting dies and punches and other time consuming grinding jobs.

No. 6-18 SURFACE GRINDER

An extremely accurate Grinder for tool room work and gage grinding, as well as production. Rugged construction and superior engineering assure accuracy over a long period of usefulness.

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You cut costs as well as metal... with UNION *end mills*

UNION DOUBLE-END END MILLS are available with four flutes — as illustrated — or two flutes, in standard or small-diameter sizes. All in high speed steel.

BUILT FOR MAXIMUM ECONOMY, Union end mills provide top performance throughout the range of end milling operations. Made of high speed steel, they have the smooth, free-cutting action that saves power, while their great strength reduces breakage to a new low. And all Union solid type end mills of ½" diameter or over have deep counterbores, considerably lengthening their resharpening life. In fact, as with all Union cutting tools, every detail of their design and construction is the result of up-to-the-minute tool engineering that saves you time, labor and money . . . *And that's worth specifying!*

THERE'S A TYPE OF UNION END MILL FOR EVERY PURPOSE

Taper Shank	**Single End**
Straight Shank	**Double End**
Shell	**Ball End**

Union is also prepared to make special types of end mills to your specifications.

no other end mill will outperform a UNION

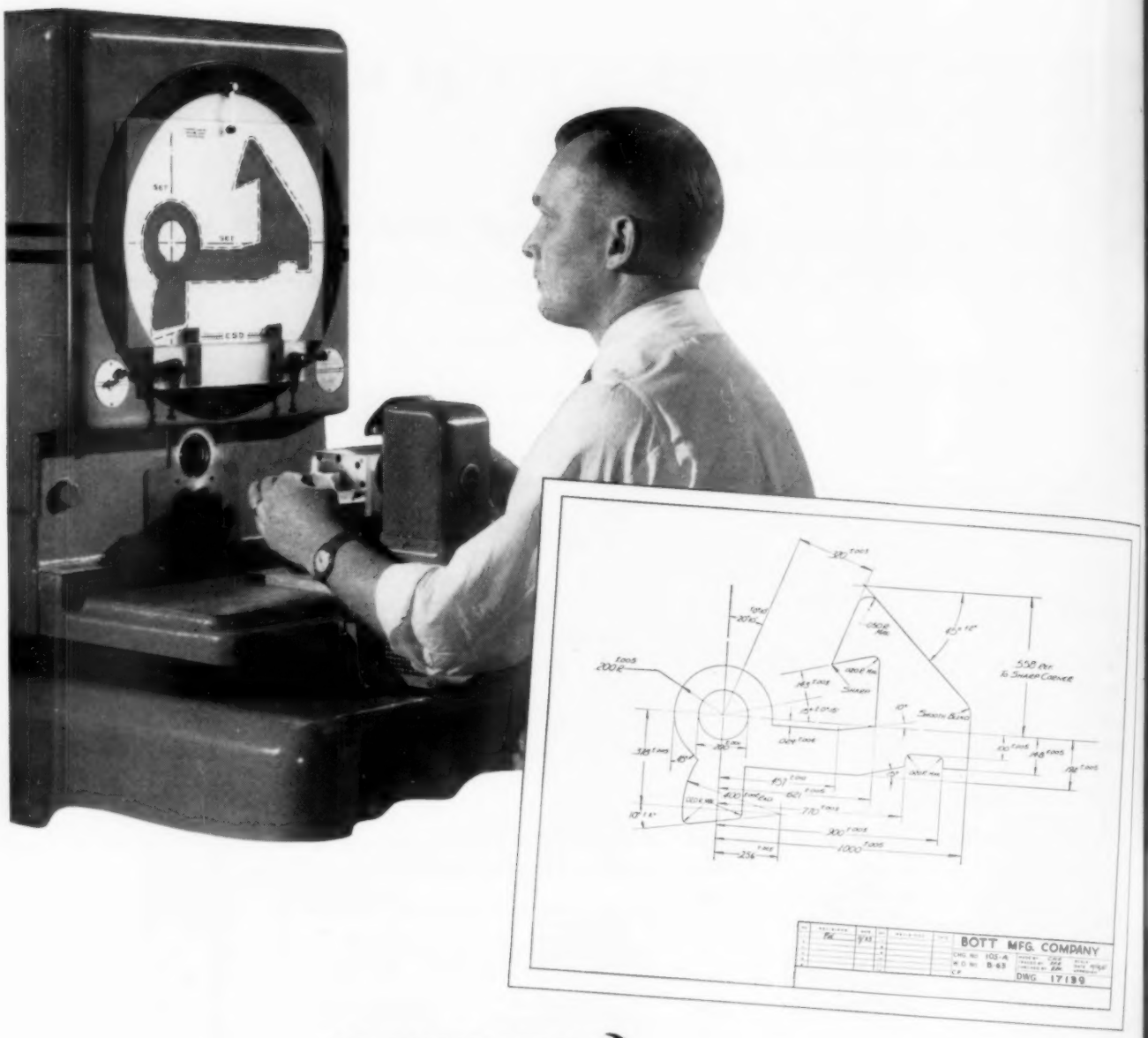
contact your local distributor

His name is listed in Union's THOMAS' REGISTER insert under "Drills, Twist."

UNION TWIST DRILL COMPANY, ATHOL, MASSACHUSETTS

Milling Cutters · Gear Cutters · Twist Drills · Hobs · Reamers · Carbide Tools

We own and operate S. W. CARD MANUFACTURING CO. Division, Mansfield, Mass. Taps, Dies, Screw Plates . . . BUTTERFIELD DIVISION, Derby Line, Vt., Taps, Dies, Screw Plates, Reamers . . . BUTTERFIELD DIVISION, Rock Island, Que., Milling Cutters, Twist Drills, Hobs, Reamers, Taps, Dies, Screw Plates.



He checks 15 DIMENSIONS 8 RADII 7 ANGLES } in ONE operation

To check this part completely and accurately by usual methods, you might need as many as two dozen or more different gages—and you still wouldn't be sure all corners were sharp, all angles and radii exact. There's a much faster, more accurate way to do the job completely, one that requires no mechanical gages that can lose accuracy through wear.

On the Kodak Contour Projector, Model 3, you just slip the part into a holding fixture and compare its magnified image with a "chart-gage" over the bright screen. *Every* detail shown on the drawing is quickly and directly compared against the part itself, to close tolerances and in *one* operation. Little training or experience is required.

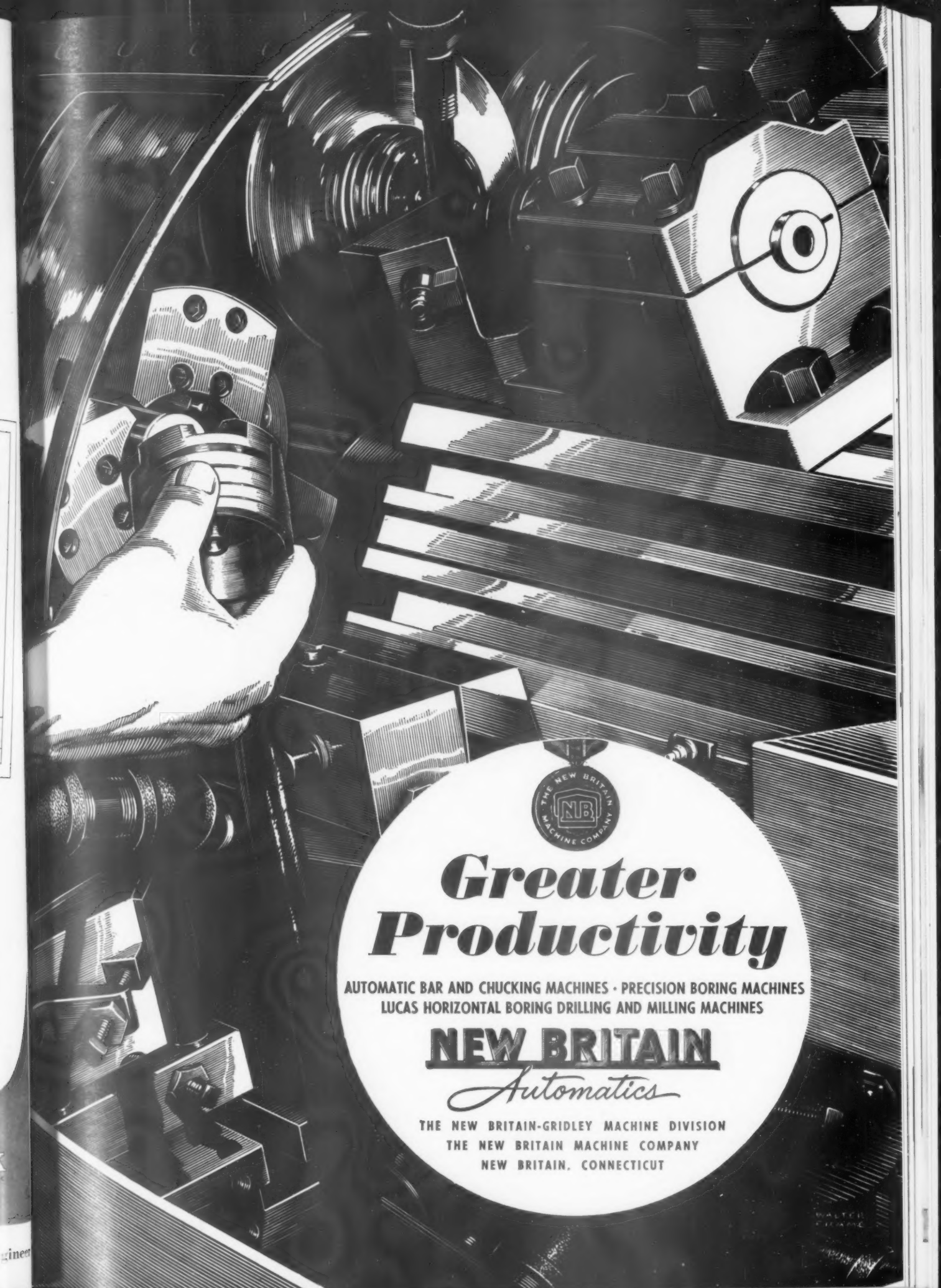
The part we show here is a relatively simple one for an optical comparator. With proper fixtures, charts, and accessories, you can measure all sorts of complex parts, large or small. Changes in specifications generally require nothing more than a corresponding change on the chart.

So overwhelmingly has industry turned to optical gaging that production of the Kodak Contour Projector, Model 3, the outstanding instrument for this method, has been greatly accelerated. Deliveries are rapid, and the cost of projector, fixture, chart-gages, and accessories usually comes below corresponding sets of mechanical gages. To get an idea of the large labor savings that the Kodak Contour Projector can bring to your inspection problems, get in touch with Eastman Kodak Company, Industrial Optical Sales Division, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

If you want to check precision spur and helical gears in action, write for information about Kodak Conju-Gage Instrumentation.

Kodak
TRADEMARK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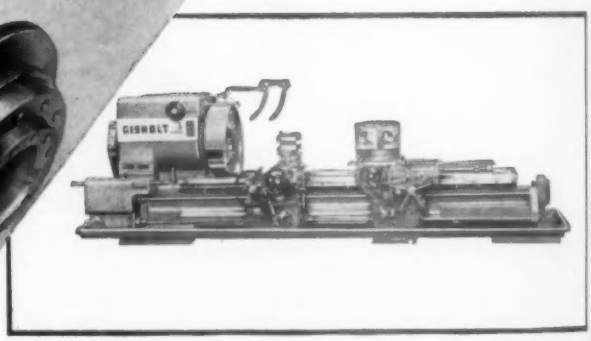


GISHOLT

Saddle Type Turret Lathes

Here's how modern Gisholts are geared for greater production—to deliver smooth, vibrationless power—instantly responsive—dependable for years to come. Note these outstanding features:

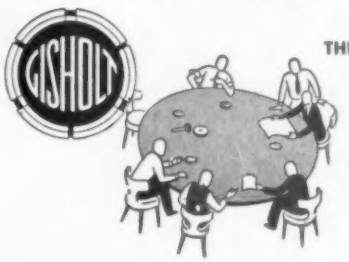
1 *Gears* . . . Husky headstock gearing will carry all the horsepower and all the load of today's tools, as well as that of the foreseeable future. Rigidity is complete from the massive headstock casting right through to the ground teeth in each gear.

2 *Clutches* . . . Warner Electric Clutches inside the drive pulley do all forward and reverse driving, as well as inching and braking. They never need adjustment and give the smoothest acceleration and braking power ever put on a turret lathe. Instant HI-LO speed changes are obtained at the touch of a finger through hydraulically operated multiple disc clutches.

3 *Bearings* . . . Two precision tapered roller bearings at the front of the spindle, together with the precision ball bearing at the rear, carry all the radial and thrust load you can give them.

Why not get all the facts? A new bulletin on Gisholt 3L, 4L, 5L Saddle Type Turret Lathes is just off the press. Write for it.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin



THE GISHOLT ROUND TABLE

represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Tandem bearings made

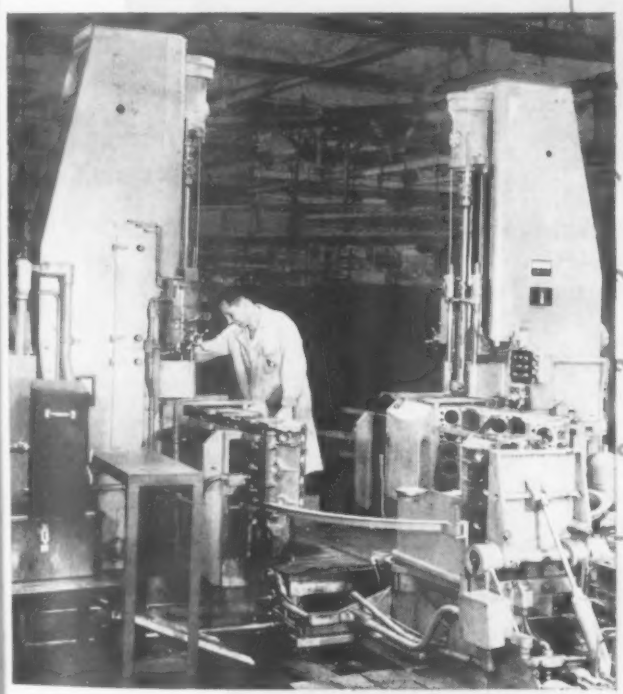
ROUND ★ STRAIGHT ★ IN LINE

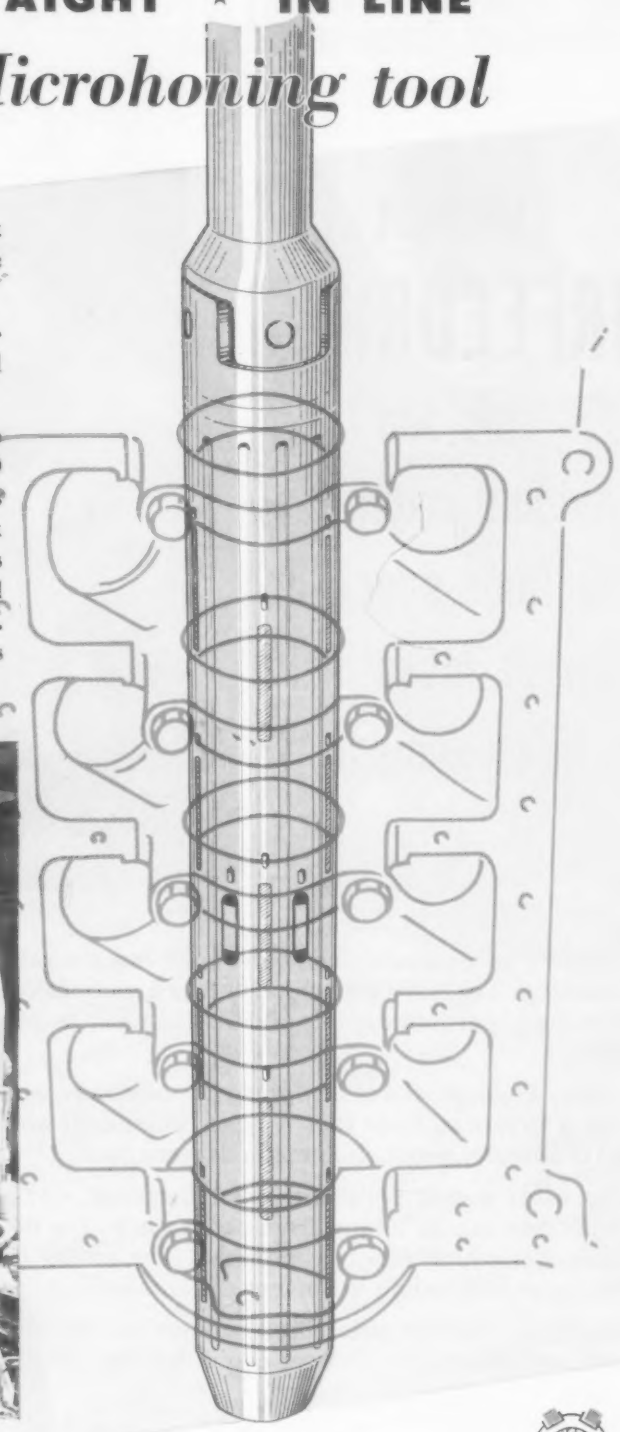
with NEW *Microhoning tool*

ALL FIVE bearings in V-8 cylinder block MICROHONED within .0005" for diametric size, roundness, straightness and alignment.

Plastic guides stabilize tool and control cutting. One bank of abrasives MICROHONE all bores.

This double column Model 740 machine equipped with new guided type MICROMOLD tools MICROHONES Main Bearings in 60 blocks per hour, removing approximately .002" stock from the diameter of each bearing. The blocks are automatically taken from the line, conveyed to either of the columns, and MICROHONED. The operator makes occasional spot checks as the blocks leave the machine.





Write for Cross Hatch for complete story on MICROHONING Interrupted Surfaces.

MICROMATIC HONE CORPORATION

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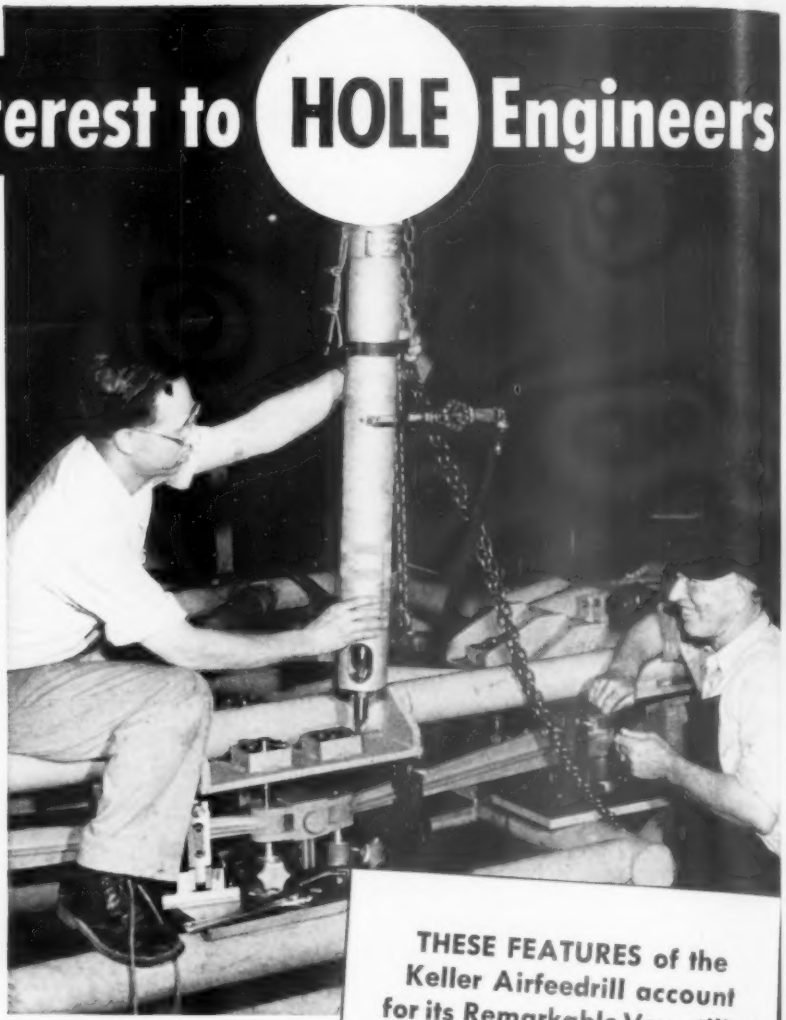
District Field Offices: 1323 S. Santa Fe Avenue, Los Angeles 21, California • 206 S. Main Street, Rockford, Illinois • 231 S. Pendleton Avenue, Pendleton, Indiana • MICRO-MOLD Manufacturing Division, Boston Post Road, Guilford, Connecticut • 55 George Street, Brantford, Ontario, Canada

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-137

...of Special Interest to HOLE Engineers

Without AIRFEEDRILLS* this Job would require more floor space and a larger investment in equipment



THESE men are machining twelve holes in a critical structural assembly. The holes pass through 3 to 5 sections of 75ST aluminum to a maximum depth of 4½″, and must be accurate to ±.0005″.

The nine forgings which comprise the assembly must be placed in a fixture so large that a huge radial drill would be required if ordinary production methods were used.

But by using a drill plate with pilot bushings, and Keller Airfeedrills that can be moved from hole to hole, the need for an expensive machine tool is eliminated. The saving in floor area alone is considered an important advantage.

Perhaps you, too, can help speed production, minimize investment, and reduce idle time of equipment by using Keller Airfeedrills.

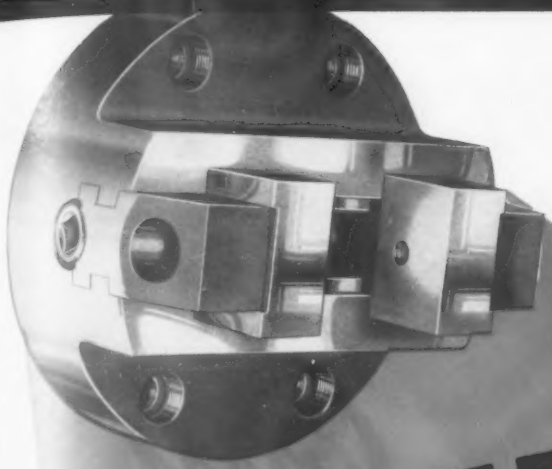
*Keller Tool Company trademark

THESE FEATURES of the Keller Airfeedrill account for its Remarkable Versatility

- Assures accurate holes without costly fixtures . . . can be used with existing jigs
- Attaches in any position and supports itself at any angle
- Operates and is controlled entirely by air . . . with pneumatic cycling to speed production, reduce operator fatigue
- Small size permits it to be used on close centers and in tight places
- Accurately drills parts too large for conventional drilling machinery
- Wide range of speeds and strokes will accommodate light or heavy metal, wood, composition, plastic
- Lightweight portable and stationary models are readily adapted to changing job requirements . . . quickly shifted from job to job

KELLER *Pneumatic Tools*

KELLER TOOL COMPANY
GRAND HAVEN, MICH.

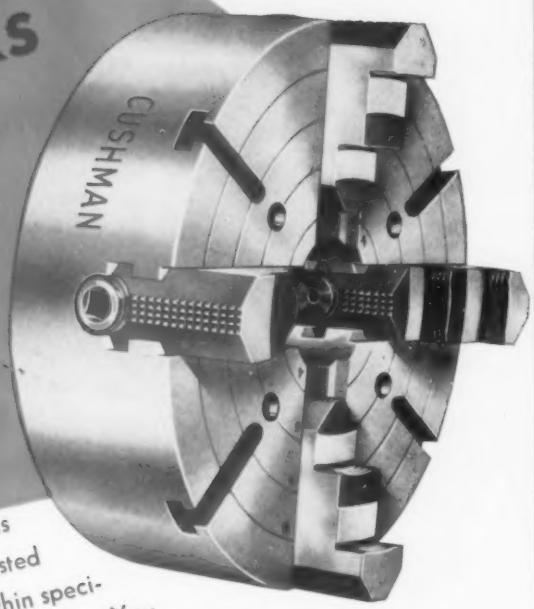


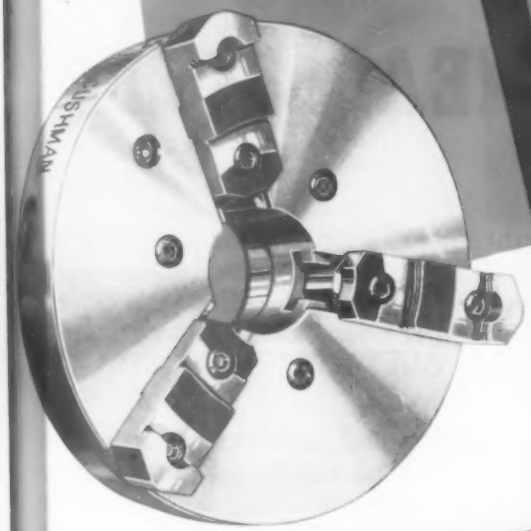
CUSHMAN

WRENCH OPERATED CHUCKS

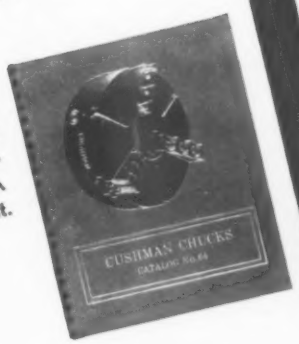
Remember that the quality and precision of your chucks control the quality and precision of your finished product.

Cushman Chucks are designed and built to meet in every respect the high precision standards of the Machine Tool Industry. Each individual chuck is carefully inspected, tested and indicated to be within specified tolerances before shipment. You can depend upon Cushman Chucks to perform well initially and to hold their high initial accuracy throughout a long service life.





Cushman Chucks are now available in an extremely wide range of sizes . . for light, medium, heavy and extra heavy duty . . . in 2, 3 and 4-jaw styles . . . independent, self-centering or combination types . . . also collet chucks and collets. Cushman also manufactures boring mill face plate jaws and the well-known Cushman Power Wrench.. Where special work-holding problems are involved, our engineering department is well equipped and always ready to serve you.



The Cushman Chuck Catalog No. 64 covers Wrench Operated Chucks in complete detail with engineering drawings and dimension data necessary for design and installation. A copy will be sent to you on request.

Cushman also manufactures Power Operated Chucks and Electric Power Wrenches.

THE CUSHMAN CHUCK COMPANY, HARTFORD 2, CONN.

Maytag Company cuts splines

like this...

...in only eleven seconds

on a SHEAR-SPEED*

Splines—straight sided, involute, or special form—and gears, sprockets, toothed clutches, etc., can be cut faster—at lower cost—on Michigan Shear-Speed machines simply because the 'Shear-Speed' accurately CUTS ALL THE TEETH AT THE SAME TIME.

When you can turn out 300 highly accurate spline shafts per hour with one machine—straight sided, ¾" OD, 2" long splines; finish-cut, with the teeth chamfered and all—it doesn't take long to pay for the machine.

**We'd like to tell you more about the Shear-Speed gear shaper. How about our sending you a copy of our latest bulletin on this machine? Ask for No. SS 1800-47.*

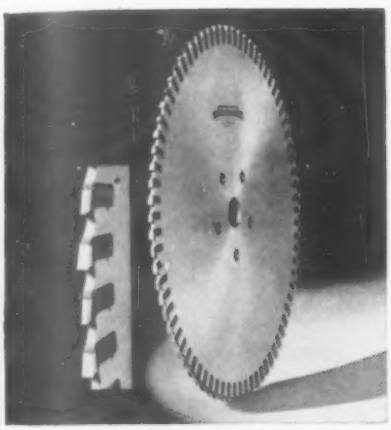
MICHIGAN TOOL Company

7171 E. McNICHOLS RD. • DETROIT 12, MICHIGAN, U. S. A.

Why run around in circles— to find the Right Circular Saw?

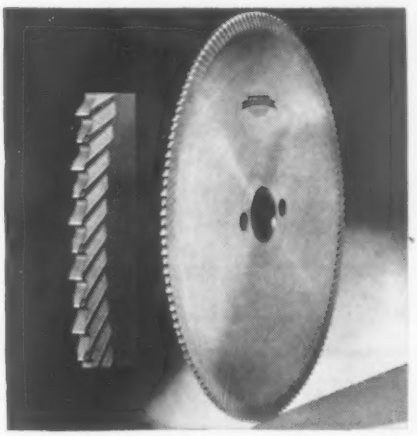
...when SIMONDS makes 'em all!

SIMONDS MAKES ALL THREE TYPES OF CIRCULAR METAL CUTTING SAWS. So you can be sure that SIMONDS will give you *the right saw for your job* . . . for any type of machine. See your Simonds Distributor *today.*



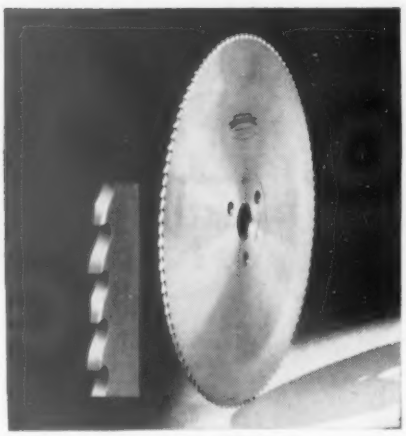
INSERTED TOOTH

For heavy production cutting, Simonds I. T. Saws are tops. Alternating square and beveled teeth "tri-vide" chips for easy cutting and clearance. An individual wedge securely anchors and aligns each tooth in the tough saw plate. What's more, this saw has maximum clearance for cool, free cutting . . . will stand an extremely high rate of feed . . . and teeth can easily be replaced singly or in complete sets right in your own plant by anyone of average mechanical ability.



SEGMENTAL

Where you require a finer tooth saw or especially smooth cuts on production work, *this is your saw.* Long-lived high-speed steel toothed segments are securely held in a tough alloy steel plate by a special tongue and groove design. Teeth are alternately square and beveled for easy cutting and clearance of "tri-vided" chips. Simonds special grinding provides ample clearance directly below the cutting points, insuring free, cool operation under all conditions. Sharpening can be done on any automatic grinder.



SOLID TOOTH

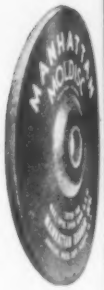
Clearance ground and furnished in High Speed, Si-Maloy (Patented), or Semi-High Speed Steel, Simonds Solid Tooth Saws are recommended for general shop cut-off requirements, for use on smaller automatic cut-off machines and for cutting operations where kerf is an important factor. Tooth design is determined by and especially suited for the application. Simonds' own steel, plus skilful heat treating and accurate grinding, insure long, dependable, trouble-free service.

SIMONDS SAW AND STEEL CO.
FITCHBURG, MASS.

Factory Branches in Boston, Chicago, San Francisco, and Portland, Ore. Canadian Factory in Montreal, Que.

MOLDISCS

SAVE HOURS AND DOLLARS
FEWER DISC CHANGES



MANHATTAN ABRASIVE WHEELS

PORTABLE WHEELS

MORE METAL REMOVED
PER MAN-HOUR

Manhattan Moldiscs have out-moded coated abrasive discs on many tough, rough finishing jobs. The abrasive is bonded throughout the Moldisc, providing ¼″ thickness of effective grinding in the standard 7″ x ¼″ x ⅞″ disc.

Manhattan Abrasive Wheels for portable grinders are engineered for the job. They satisfy workers on incentive pay who want high grinding speeds. They satisfy management men who want good quality production and lower costs.

WRITE TO ABRASIVE WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION
RAYBESTOS-MANHATTAN, INC.
PASSAIC, N. J.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose • Fan Belts • Brake Linings • Brake Blocks • Clutch Facings • Packings • Asbestos Textiles • Powdered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

Want longer wear?

You'll get *longer wear* with American drill jig bushings. Accurate in every detail and made of the finest oil hardened tool steel, with precision finished bores, they have a l-o-n-g life. They have concentric ground leads for perfect alignment. You'll get *longer wear* from drills and reamers too. Ask for them—get immediate delivery from any of our many distributors throughout the U.S. and Canada—specify American Drill Jig Bushings *FOR LONGER WEAR.*

LOOK FOR THE TRADE MARK

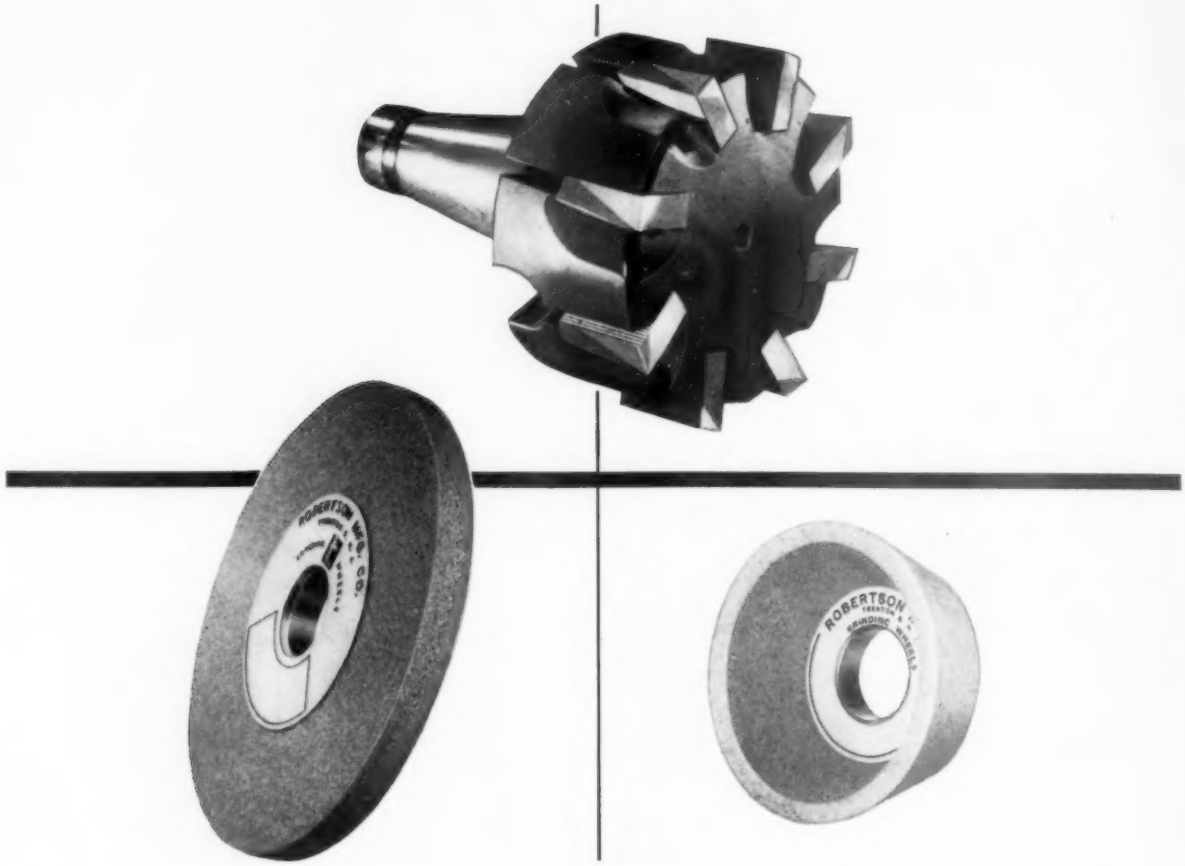
SPECIALIZING ONLY IN DRILL JIG BUSHINGS

Send for Catalog and name of nearest Distributor

American DRILL BUSHING CO.

5107 PACIFIC BOULEVARD, LOS ANGELES 58, CALIFORNIA

Grinding VASCO Supreme Inserted-Tooth Cutters



with ROBERTSON WHEELS

Vasco Supreme presents many tough grinding problems because of its extreme abrasion resistance.

In fact, it is almost impossible, when grinding inserted-tooth milling cutters, to line the tools up in true cylindrical form. For that reason they have to be ground to true diameter. Due to the intermittent cutting, an out-of-true surface soon deforms that of the grinding wheel, and sets up chatter.

With ordinary materials this job is very difficult, and with Vasco Supreme it is even more so. Yet an 8" x ½" x 1½" RA605-MV Robertson Wheel, used on a small Landis universal tool and cutter grinder, took this tough job in stride. It trued a 6" diameter cutter with new blades and was dressed only once—just for the final finish. For the regrind, four cutters were sharpened without a dressing—and then only to maintain a keen, smooth cutting edge.

Backing off was done on a Cincinnati tool and cutter grinding machine with a Robertson LA465-JVC, Type 11 Cup. Each tooth was sharpened individually. Because of the wide surface, a double clearance was ground to reduce the cutting area. Longer wheel life and a quicker job were thus obtained.

The slower the work rpm, the faster the grinding. This not only applies to the work speed, but the wheel speed as well. When a pounding or peening action is heard, the wheel should be redressed or trued.

Precision-built Robertson Wheels are proving themselves daily on tough production-line jobs the country over. If you have an "impossible" job, just blueprint your problem and let us recommend a wheel that will solve it.

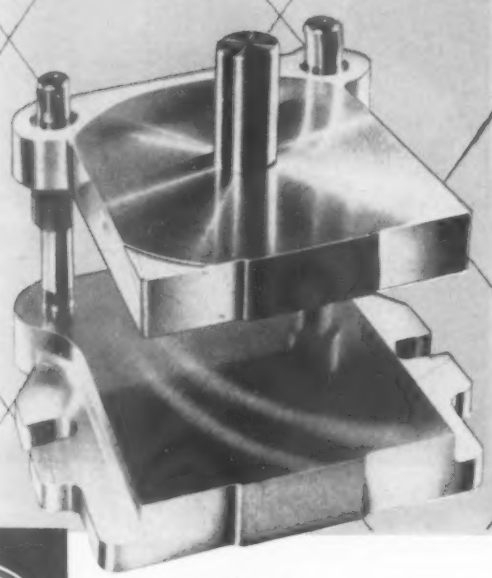
ROBERTSON MANUFACTURING CO.
TRENTON 5, NEW JERSEY

RESIN-BONDED AND VITRIFIED-BONDED GRINDING WHEELS • MOUNTED WHEELS • SEGMENTS

GET INTO PRODUCTION

Faster!

Save Tooling Time



DANLY

PRECISION DIE SETS

SEND FOR YOUR FREE COPY OF THIS NEW BOOKLET TODAY!

You save time when you "tool up" with Danly Die Sets . . . preferred by diemakers everywhere. Check the unique precision features that mean faster die completion and longer production runs . . . see how the nationwide system of Danly assembly branches reduces costly delivery delays. Write for your copy now . . . Danly Die Sets are certain to help you meet production schedules.

DANLY®

DANLY MACHINE SPECIALTIES, INC. 2100 South Laramie Avenue, Chicago 50, Illinois

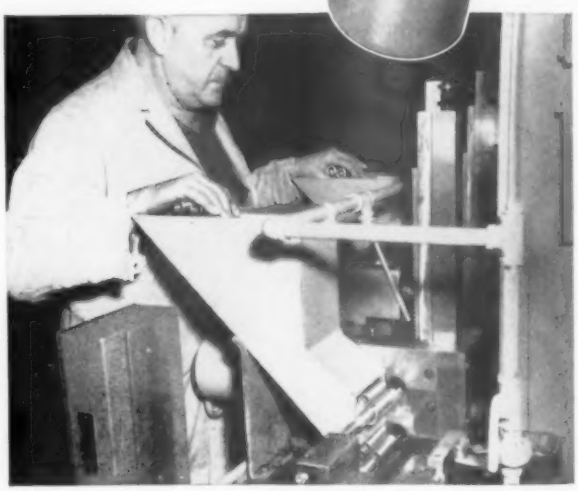
Continuous, Automatic Cycle produces 1150 parts per hour!

TYPICAL EXAMPLE OF HIGH PRODUCTION ENGINEERED THE *American* WAY

To broach radius notches in automotive piston pins, American engineers designed a *completely automatic* two station fixture featuring *continuous cycling.* Each station broaches two parts. Installed on an American T-4-24 Broaching Machine, equipped with a special work table, this fixture permits broaching four parts simultaneously . . . produces more than 1150 parts per hour.

SIX AUTOMATIC OPERATIONS ENGINEERED IN CONTINUOUS CYCLE FIXTURE

The operator has only to keep the gravity-type loading hopper filled with parts. A transfer pusher pushes two parts at each station into position where they are hydraulically clamped in V nests. The main slide starts down broaching the four parts simultaneously. At the end of the stroke the transfer pushers push the part into a chute in the center of the machine where they are ejected. The transfer pushers and broaches return to the starting position and the cycle repeats. All operations are electrically interlocked.



SOLVE YOUR BROACHING PROBLEMS THE *American* WAY

Continuous, automatic cycling is only one way that American engineers help manufacturers get high production. Perhaps an American-engineered installation will increase production in your plant. To get American's recommendations send a part print or sample and hourly requirements.

AMERICAN *American* BROACH & MACHINE CO.
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.
ANN ARBOR, MICHIGAN

SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

THE 1952 QUESTION—Answered

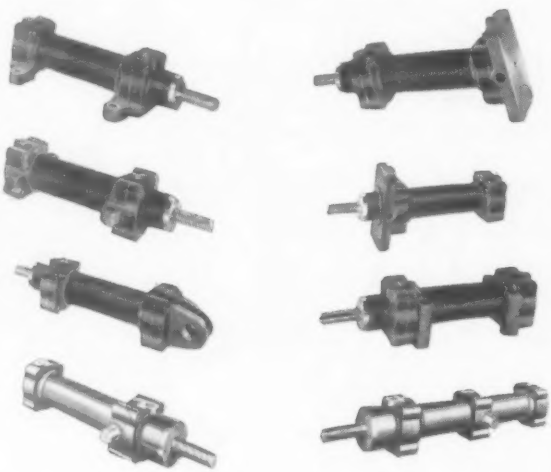
HYDRAULIC CYLINDER BULLETIN 110
52 pages of illustrated, helpful specifications and engineering data on the complete line. 12 standard bore diameters. Cushioned or non-cushioned types. 11 standard mounting styles. Many combination mountings.

PNEUMATIC CYLINDER BULLETIN 210
49 pages on pneumatic cylinders. Design features and dimension tables. Two types of pistons. 12 sizes; combination mountings; any length stroke; plain or cushioned.

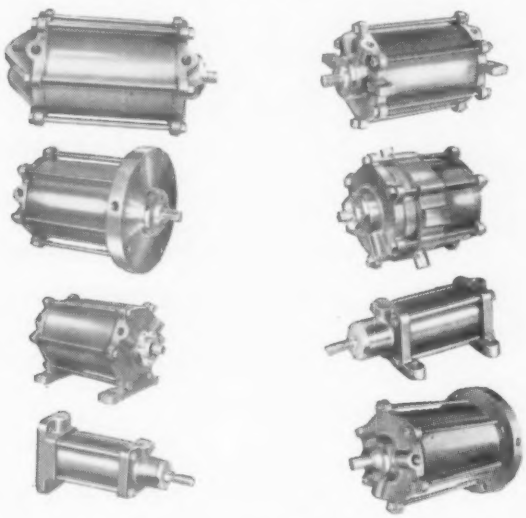
Q: This year our number one problem is to improve our product design—make it do its job better. Same thing goes for our production line machines . . .

. . . think I've got the answer, Boss. Been talking with the Hannifin man, and he's shown how we can modernize our machines and methods by using hydraulic and pneumatic cylinders. **:A**

HYDRAULIC CYLINDERS



PNEUMATIC CYLINDERS



A FEW OF THE MANY MOUNTING STYLES IN THE HANNIFIN LINE OF HYDRAULIC AND PNEUMATIC CYLINDERS

Take a big step toward solving many of *your* machine design problems. Call *your* Hannifin man in

Atlanta, Chicago, Cincinnati, Cleveland, Dallas, Dayton, Detroit, Houston, Los Angeles, Milwaukee, Minneapolis, Moline, New Orleans, New York, Philadelphia, Pittsburgh; Richmond, Va.; Rochester, N. Y.; St. Louis, San Francisco, Seattle; South Bend, Ind.; Washington, D. C.; or Worcester, Mass. In Canada, F. F. Barber Machinery Co., Toronto, Montreal, Windsor, Hamilton, Vancouver

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Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Hydraulic Riveters • Air Control Valves

HANNIFIN CORPORATION
1119 S. Kilbourn Ave., Chicago 24, Illinois

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Name .....

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★ **ARCALOY** for stainless steel

★ **ARMOR-ARC** for armor welding

★ **BRONZE-ARC** for bronze and cast iron

★ **WELD-ARC** for low hydrogen electrodes

★ **NICKEL-ARC** for cast iron

★ **TOOL-ARC** for tool steel

★ **WEAR-ARC** for hard facing

★

NAMES TO REMEMBER IN ARC WELDING

100% of all *Alloy Rods* production is still being sold through our fine Distributor organization. We are shipping more alloy arc welding electrodes than ever before . . . and while our Distributors may temporarily be out of stock on certain types, we urge you to keep in touch with them on your requirements. After all, *quality* is always worth waiting for.

ALLOY RODS COMPANY

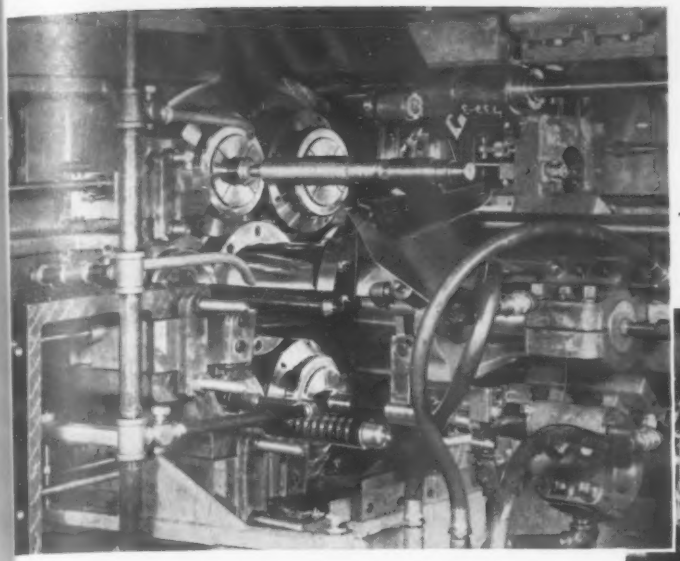
No Finer Electrodes Made . . . Anywhere

YORK, PENNSYLVANIA

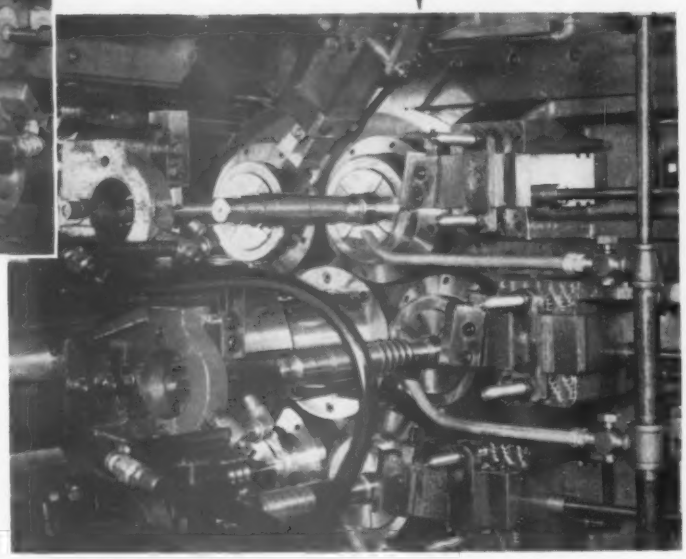
Alloy Rods Co.

★ *See your nearest Alloy Rods Distributor*

AR-2



Tooling Area 3½-SIX
Front Side Rear Side



Automotive Transmission Shaft

A very good reason why CONOMATICS handle a wider variety of machining operations per single chucking is their greater number of tooling positions.

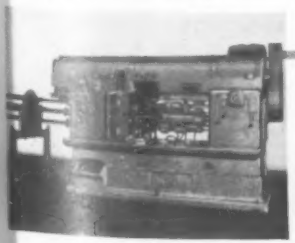
WITH MORE TO SELL THERE'S MORE TO TELL

Whether you're selecting a new golf club, motor car, or multiple spindle bar automatic, you want what best fits into the "scheme of things."

Before you can be sure that any product will meet your requirements you must have information. And you can judge only by that at hand or available. Complete information lets *you* decide what's important to *you.* That's as it should be.

There's always more information to be had about the product that has more to offer. It's that way about CONOMATICS. And you can always have *complete* information. If you will write, wire, or phone, you can have it now.

A Comparison of ALL Automatics is in favor of Cone



Conomatic CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

1. Style MM on drill press. 2. Style DM on B & S automatic. 3. Style TM cutting taper threads on double-end threader. 4 Style MM on multi-spindle automatic. 5. Style DMS on turret lathe. 6. Style MM on threading machine.

The majority of producers of threaded parts prefer H&G insert chaser die heads

BECAUSE: **1** H&G cut high quality threads, straight, smooth and accurate to Class 3 fits. **2** Positive trip opens chasers at exact length of thread, an advantage for threading close to a shoulder. **3** Chasers are easily changed by any operator in two or three minutes. **4** The same set of chasers can be used in several styles and sizes of die heads. This interchangeability plus the low price per set reduces chaser inventory and investment. **5** The initial low cost of chasers and their extraordinary life insure new low threading costs.

Check and mail for free bulletins: ☐ How to select proper die head for the job.
☐ Style MM ☐ Style DM ☐ Style TM ☐ Style DMS.

THE EASTERN MACHINE SCREW CORPORATION • 27-47 Barclay Street, New Haven, Conn.

AIR CIRCUIT DESIGN SIMPLIFIED WITH THIS SOLENOID CONTROLLED AIR POWERED AIR VALVE

COMPLETE: Combines in one unit 4-way directional slide valve, piston rod speed regulators and low voltage solenoid controls.

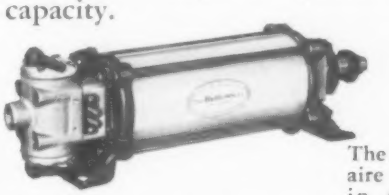
COMPACT: The ¼" port size takes no more space than a king-size package of cigarettes.

SAFE: Low voltage activation assures electrical safety to operator and machine. Solenoid controls guaranteed against burn out.

FAST: Speeds up to 2200 valve movements a minute.

The Bellows Electroaire* Valve gives design engineers a method of air control that is compact, fast, safe, flexible, positive and reliable. Taking no more space than a king-size package of cigarettes, it fits easily into cramped quarters or on moving machine elements. The Electroaire Valve is bullet fast, yet it will operate hour after hour without hum or pounding. Low voltage operation simplifies wiring problems, and gives positive assurance of electrical safety for operator and machine. Sturdily built, the Electroaire Valve will give almost unlimited service. Records of 20,000,000 to 30,000,000 cycles are not uncommon.

The Bellows Electroaire Valve is made in three port sizes: ¼", ⅜", ½". It can be arranged for direct connection to or remote control of any air cylinder of suitable capacity.



The Bellows Electroaire Valve is a built-in feature of all Bellows "Controlled-Air-Power" Devices arranged for electrical control.

Write for these

FREE BULLETINS

Case histories, wiring diagrams, technical data on the Electroaire Valve and other Bellows pneumatic equipment. Ask for Bulletins AV-300 and CL-30. Address: The Bellows Co., Dept. TE-152, Akron 9, Ohio.

*TM REG PAT PENDING 1292

The Bellows Co.

ESTABLISHED 1911

AKRON 9, OHIO

FIELD ENGINEER OFFICES IN ALL PRINCIPAL CITIES

CLEVELAND tapping machines *lead screw*

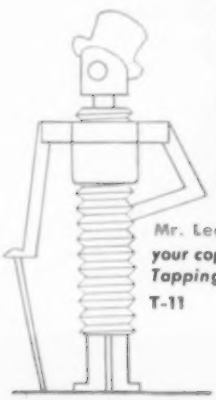
CLEVELAND Tapper Turns Out Two 20 MM Shells Every 6.1 Seconds

Operating at 100% efficiency, the CLEVELAND Tapper we designed for munition makers taps two 20 MM shells per machine stroke at the rate of 1180 pieces per hour. It uses a stroke of ½" cutting at a spindle speed of 420 RPM at 68 SFM with a tapping cycle of 36 turns or 5.1 seconds plus 1.0 second for the table index, making a total work cycle of 6.1 seconds for the two shells.

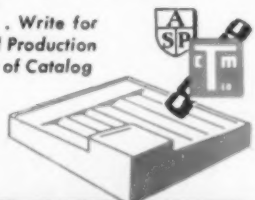
Other CLEVELAND models are producing such vital defense items as 3.5 rocket bodies . . . 90 MM shells. In many plants throughout this country and abroad CLEVELAND Tappers are reducing production costs and saving priceless man hours. A semi-skilled worker equipped with a CLEVELAND Tapper engineered to the job becomes a skilled operator

CHECK WITH CLEVELAND FIRST

if you need to perform any of these operations: Tapping . . . Threading . . . Drilling . . . Spot-facing . . . Reaming . . .Chamfering. Cleveland engineers can help you with your problem, show you how to effect economies in these operations.



Mr. Lead Screw says . . . Write for your copy of the Cleveland Production Tapping Guide and a copy of Catalog T-11



THE CLEVELAND TAPPING MACHINE CO.
A Subsidiary of AUTOMATIC STEEL PRODUCTS, INC.
CANTON 6, OHIO

USE READER SERVICE CARD; INDICATE A-1-152-1

DRILL HARDENED STEEL WITHOUT ANNEALING WITH "HI-ROCKWELL" DRILLS

Every toolroom needs Champion "Hi-Rockwell" drills. These tools drill precision holes in steels testing C-40 to C-68 Rockwell quickly and without annealing. Ideal for reworking tools and dies, they actually cut a curled chip! *THEY CUT!!!*

Some sales territories open.

Available in standard sizes—from stock of:

CHAMPION TOOL CO.

24060 Orchard Lake Rd. Farmington, Michigan

We also are the manufacturers of the Nu-Mikro piston grooving tools.

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ACTION-PACKED . . . production-boosting 16mm films for your next technical meeting, training school program or production clinic.

Production-Tip Movies for Your Meetings! without cost or obligation!

"MULTIPRESS — and how YOU can use it" . . . Multipress at work on a wide range of actual, unstaged operations such as broaching, trimming, forming, marking, crimping, assembling, staking and testing. (30 minutes long.)

"INDEX TO PROFITS" . . . Follow the assembly of an intricate 34-piece automobile door latch through a highly compact, production line that saves space and cuts lost motion to the minimum. (20 minutes running time.)

WRITE DENISON or contact the Denison representative in your area giving your film choice and showing date.

DENISON HydrOILics

The Denison Engineering Co.
1191-A Dublin Road
Columbus 16, Ohio

USE READER SERVICE CARD; INDICATE A-1-152-3

Check Your Own Gage Blocks

DIRECTLY IN MILLIONTHS *with the*

MICRO-AC
ELECTRONIC MICROCOMPARATOR

■ **SUPER-SENSITIVE!** Reads directly in .000001" and .000010" per division, either side of zero, on continuous linear scales. Both scales always give same reading.

■ **DEPENDABLE!** *Frictionless movement* and *freedom from drift* assure CONSISTENT REPEAT READINGS.

■ **PRACTICAL!** Has instantaneous meter response; easy-to-read scales; quick setup. Thoroughly proven by gage block makers and in gage departments of leading plants.

FREE MICRO-AC BULLETIN
GIVES FULL DETAILS. WRITE FOR IT!

AND ASK about the INDI-AC Electronic Indicator for all-around use; PAR-AC Electronic Production Gage.

Graham-Mintel INSTRUMENT CO.
741 CARNEGIE AVE. • CLEVELAND 15, OHIO

USE READER SERVICE CARD; INDICATE A-1-152-4

X Marks the Spot

X marked the spot, high on the performance chart. That's where Company A's production curve should have gone. Alas, it went *down* instead!

"Just what you'd expect," said the foreman. "This job calls for pretty near gage-block precision. To get that you have to sacrifice speed, don't you?"

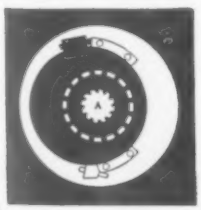
Well—Company B had a similar job. Their production showed an up-curve.

How were they doing it?

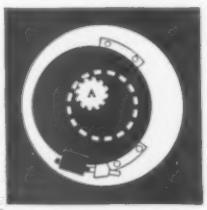
Company A found the answer in the new booklet, "SOLVED: The Production Up-Curve Mystery." It tells how to do high precision metal-working at top production speeds . . .

Write for your copy today.

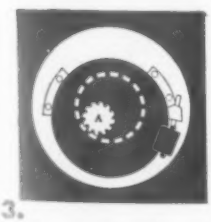
A PLANETARY FORM MILLER;
A PLANETARY THREAD MILLER; and
A COMBINATION FORM and THREAD MILLER
FOR BOTH INTERNAL AND EXTERNAL OPERATIONS



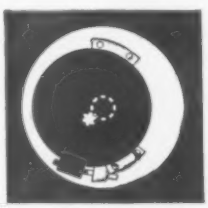
1. The work (dotted white circle) does not revolve. Cutter is revolved around work.



2. For internal thread and form-milling, cutter (A) moves out from center to contact with work.



3. Cutter moves in circle, completing cut; rapid reverse returns cutter to center.



4. For external milling cutter moves in to contact work; then moves around work.

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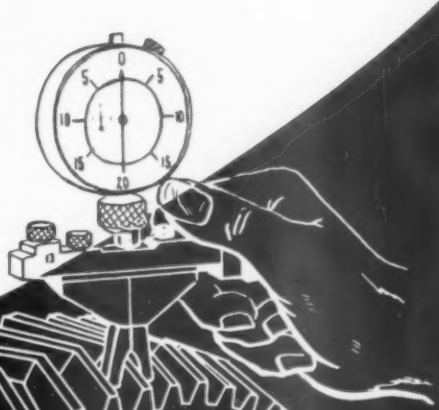

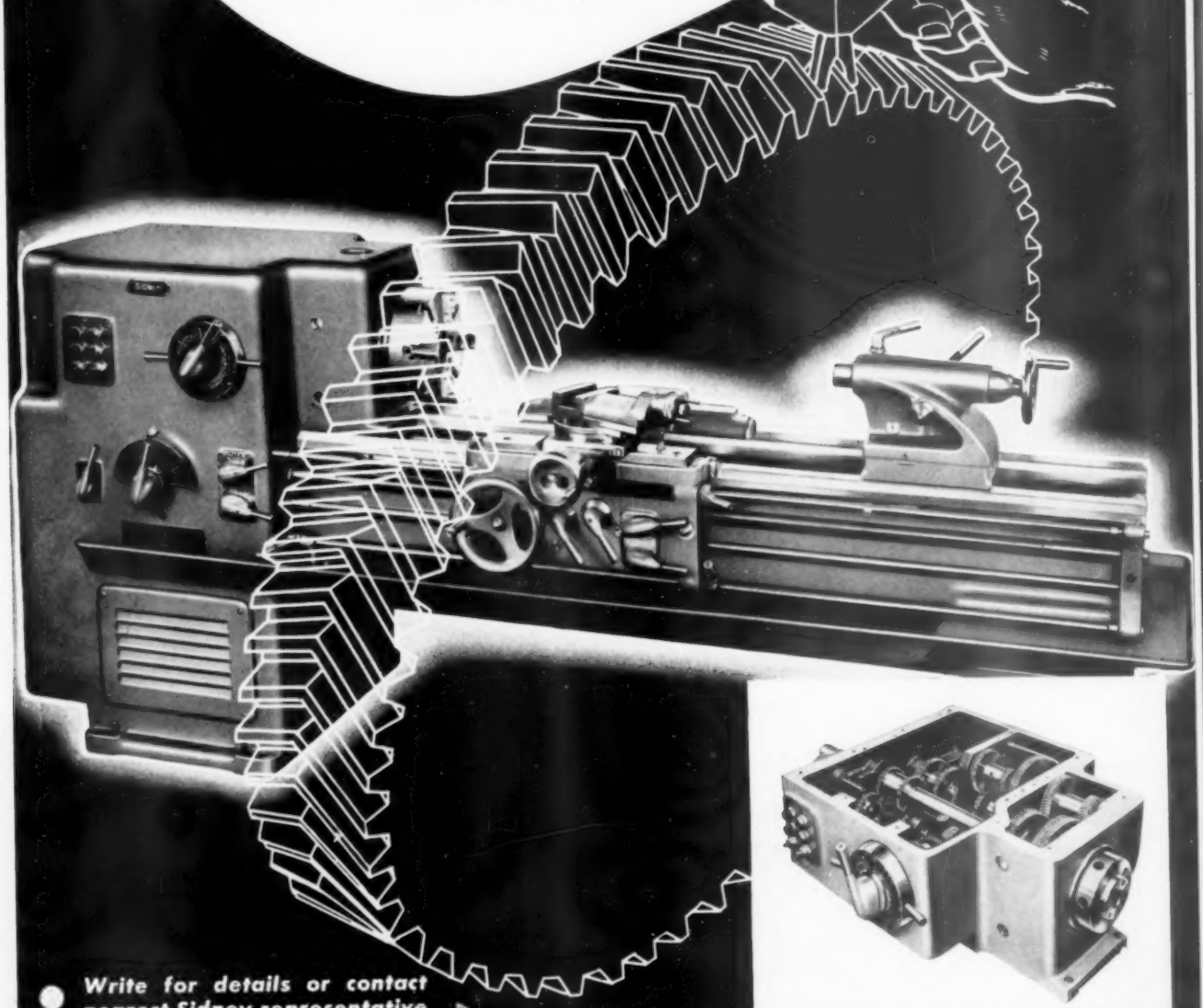

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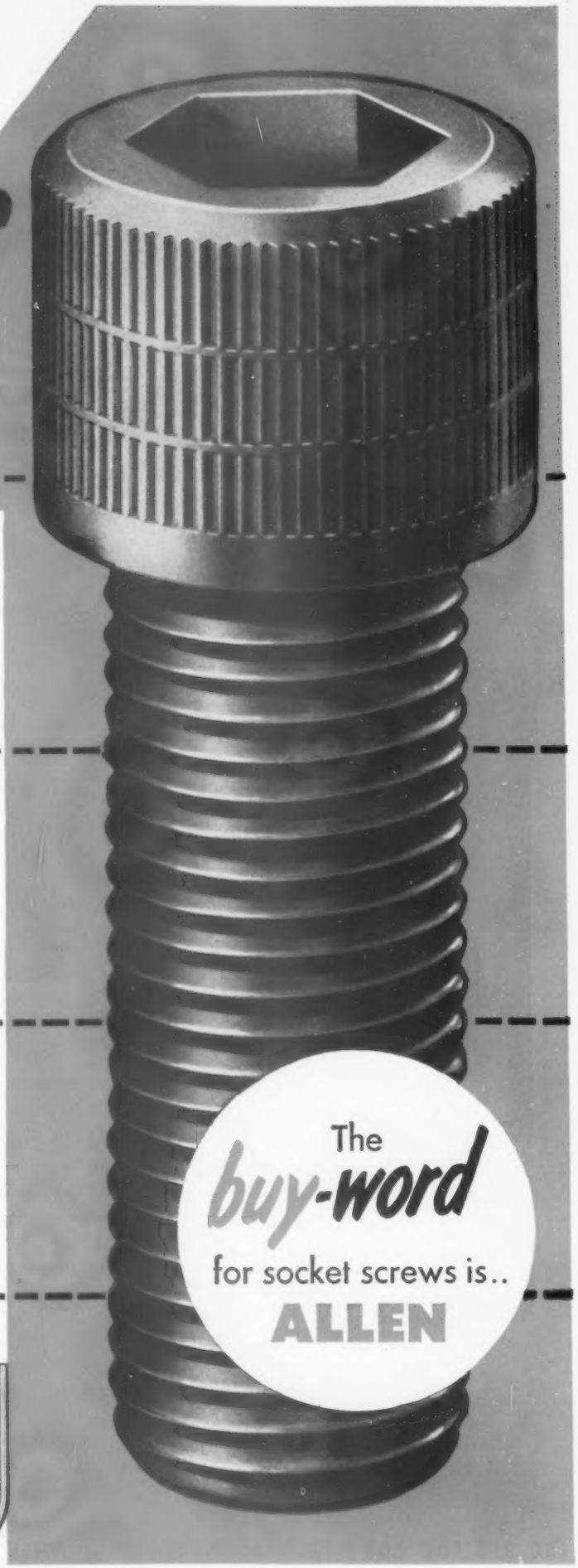

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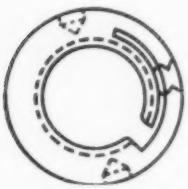
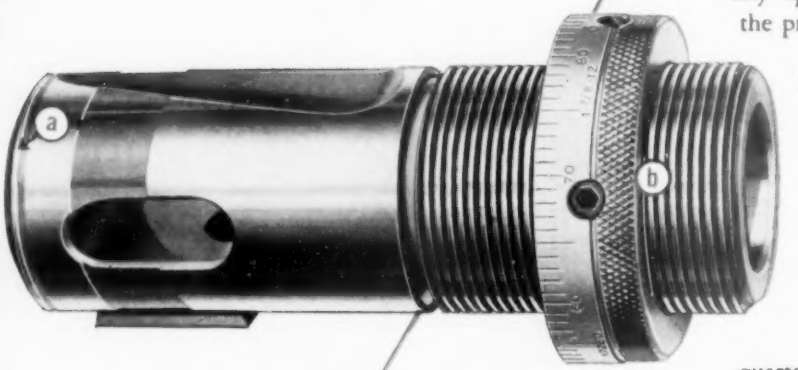
ADJUSTABLE ADAPTERS and SPINDLE EXTENSION ASSEMBLIES





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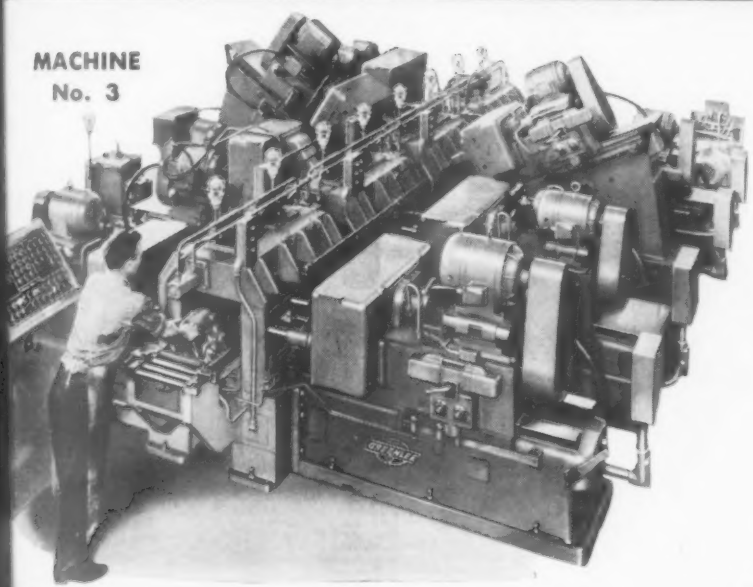

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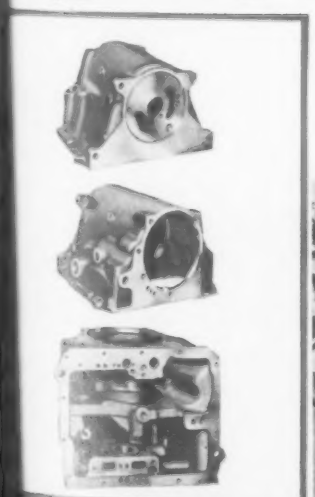

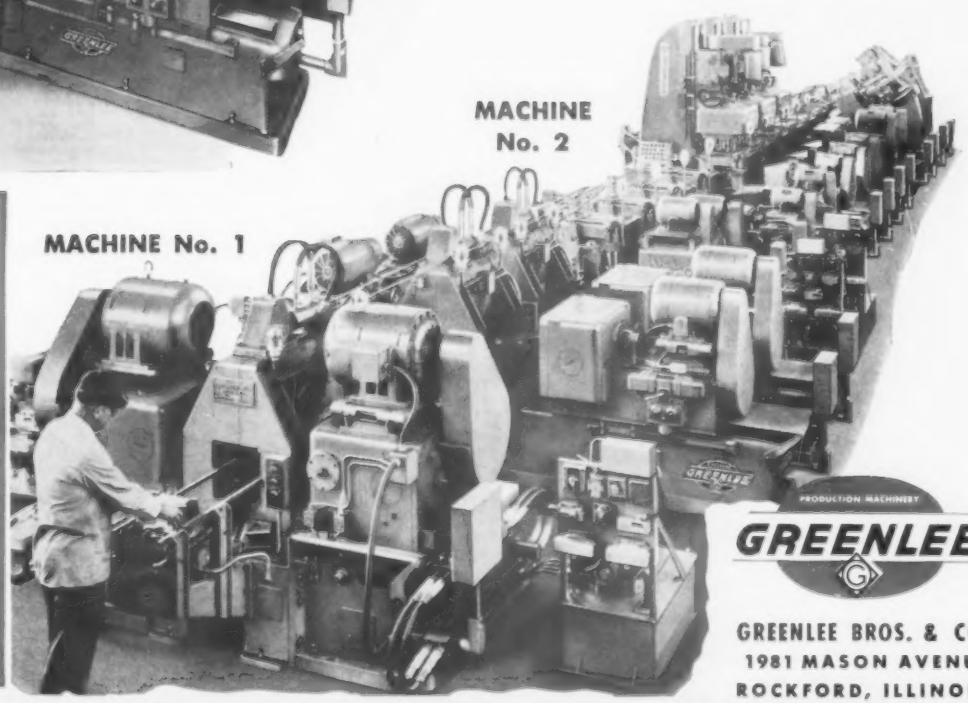

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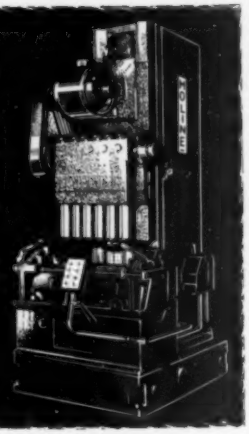

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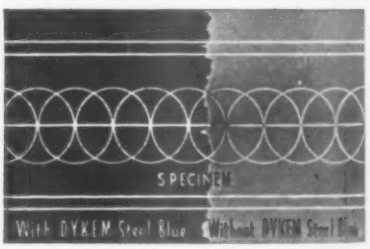

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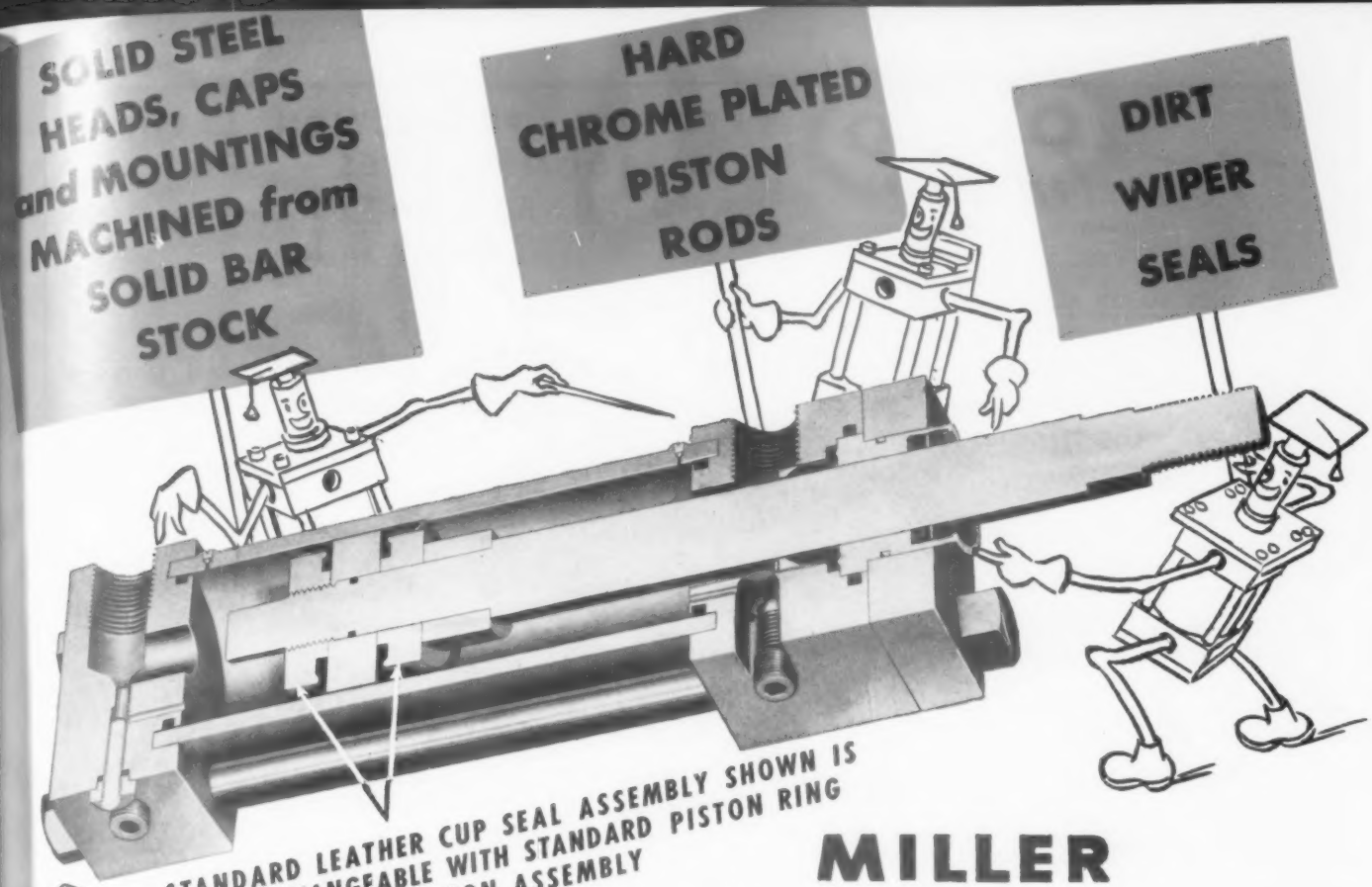

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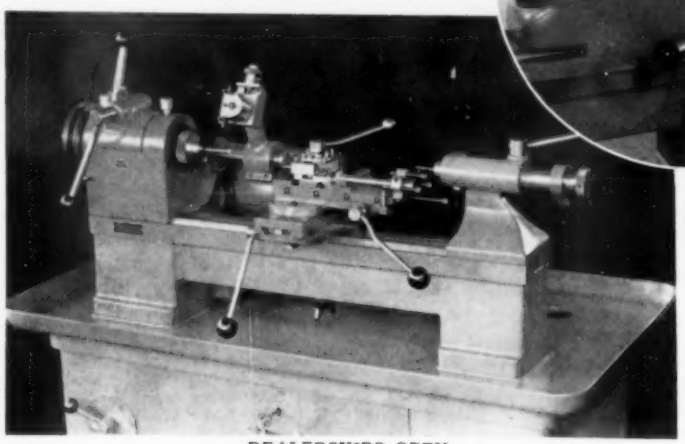

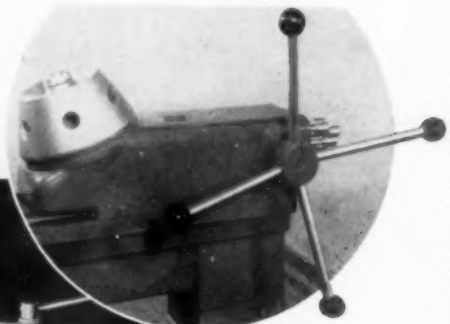

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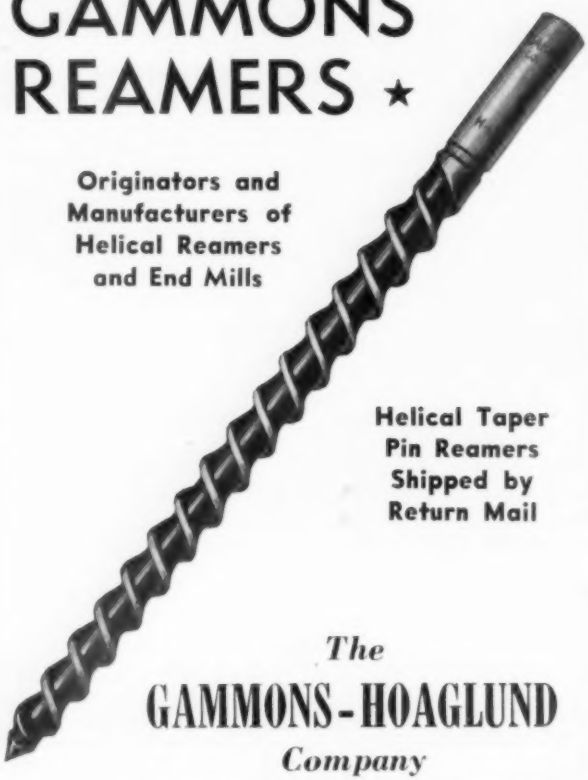

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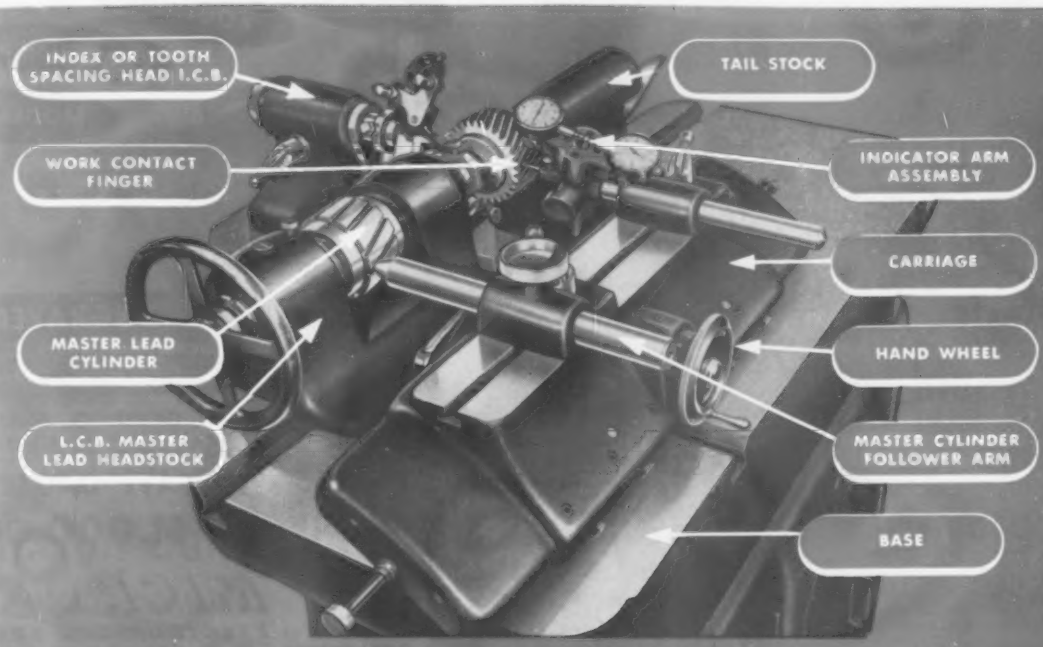

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QUICKLY and ACCURATELY

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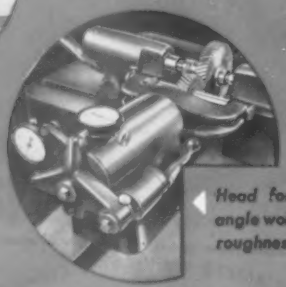
Model ECA Head checks eccentricity and tooth size.

Model CPA Head checks parallelism.



Head for checking helix angle wobble, eccentricity, roughness of roll and size.

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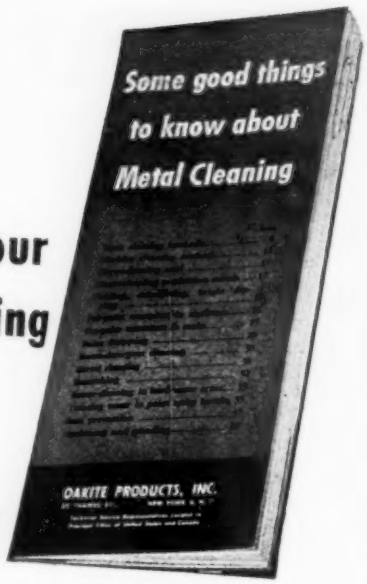

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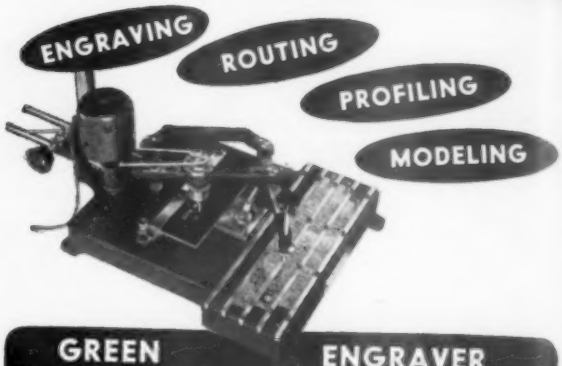

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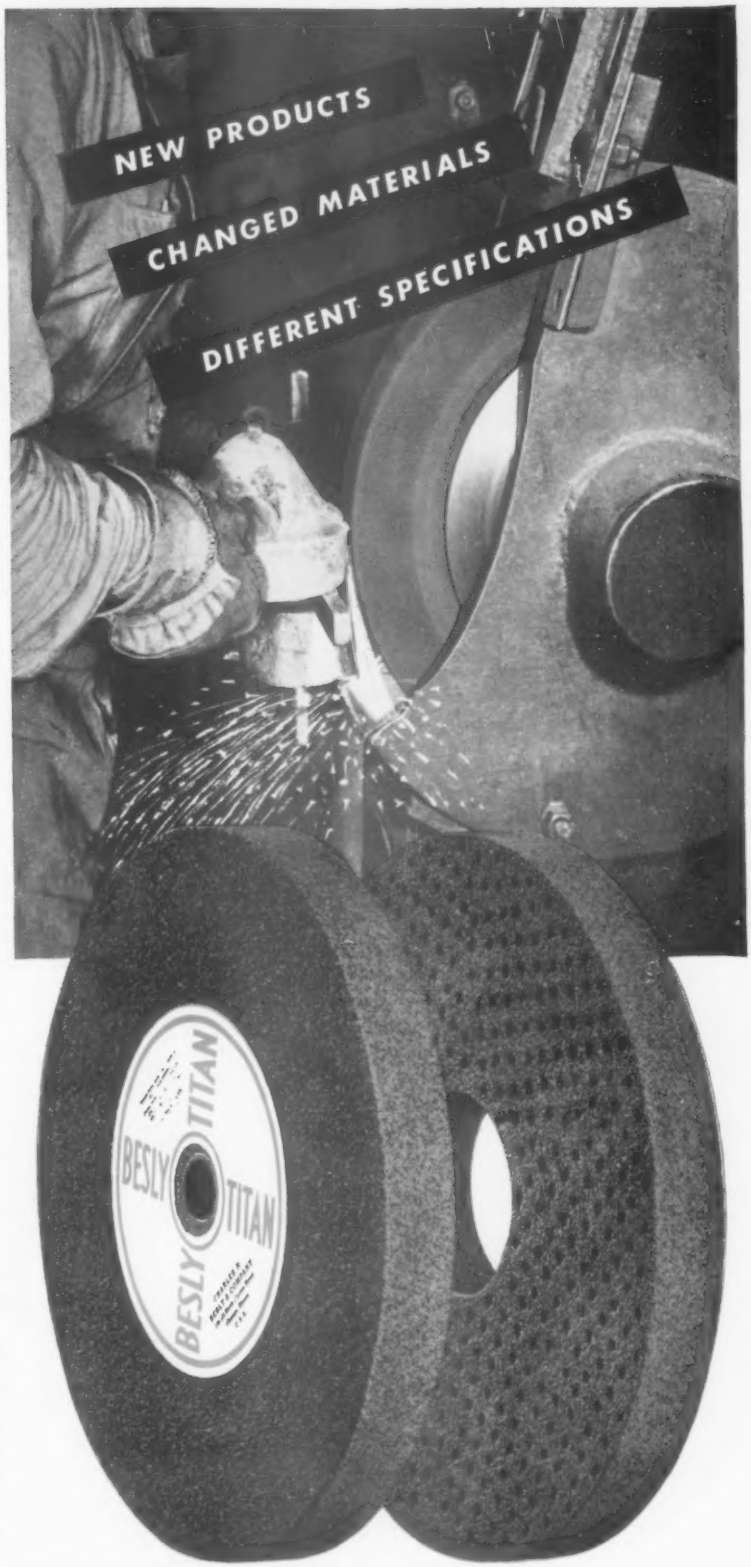
"Job-Fitted" ABRASIVES

are BESLY's answer to today's production conditions



More Grinds Per Wheel
Deliveries In Just a Few Days
Full Usage of Abrasive
Fast, Cool Cutting
Less Frequent Dressing
Fewer Wheel Changes
Longer Wheel Life

Changing production schedules mean new products, substitute materials and altered specifications. Each can be handled correctly by abrasive modifications. Besly representatives know products, materials and processes —especially how to maintain high uniformity in production grinding—with every piece the same. Write us to have a Besly-Titan field engineer discuss your grinding needs . . . and ask for a catalog.

IT COSTS NO MORE . . .

In meeting today's high production demands, it's vitally important to work with abrasive discs and wheels best suited to *your specific needs*. Besly is able to supply you with compounded-to-specification abrasives that will do many jobs better . . . and you can count on deliveries in a matter of *days*—not weeks as might be expected. It pays to have your job specifications filed with Besly for same-week delivery of *made-to-order* wheels and discs.

BESLY-TITAN *Custom-Made Abrasive Wheels and Discs*

BESLY-WELLS CORPORATION

Established as CHARLES H. BESLY and COMPANY in 1875

20 N. WACKER DRIVE • CHICAGO 6, ILLINOIS

REPRESENTATIVES IN PRINCIPAL CITIES

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-165

Jarvis

FOR SERVICE

FOR QUALITY

Machine
Ground-from-the-Solid

TECNI-TAPS

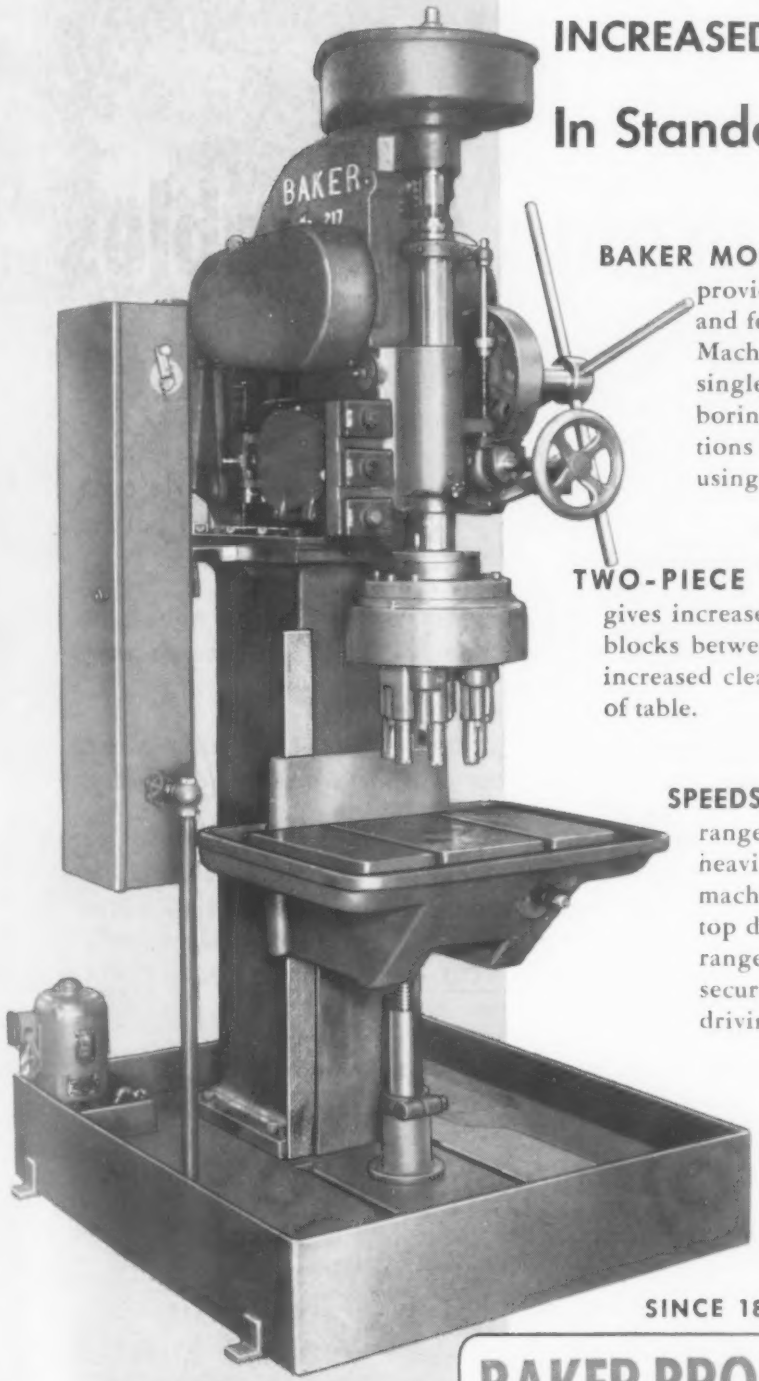
THE CHARLES L. JARVIS CO.
MIDDLETOWN IN CONNECTICUT

TAPPING ATTACHMENTS • TECNI-TAPS • FLEXIBLE SHAFTS and MACHINES • ROTARY FILES • TUNGSTEN CARBIDE REAMERS and MILLS • DRILLS • BORING BITS

BAKER

MEANS Versatility... INCREASED Productivity...

In Standard Drilling Machines



BAKER MODEL 217 HEAVY DUTY DRILL provides a selection of spindle speeds and feeds secured through pick-off gears. Machine can be adapted to heavy duty single spindle drilling, counterboring, boring, facing, forming or tapping operations and to multiple spindle operations using multiple spindle heads.

TWO-PIECE VERTICAL FRAME DESIGN gives increased flexibility allowing use of spacer blocks between lower and upper frames to give increased clearance from ends of spindles to top of table.

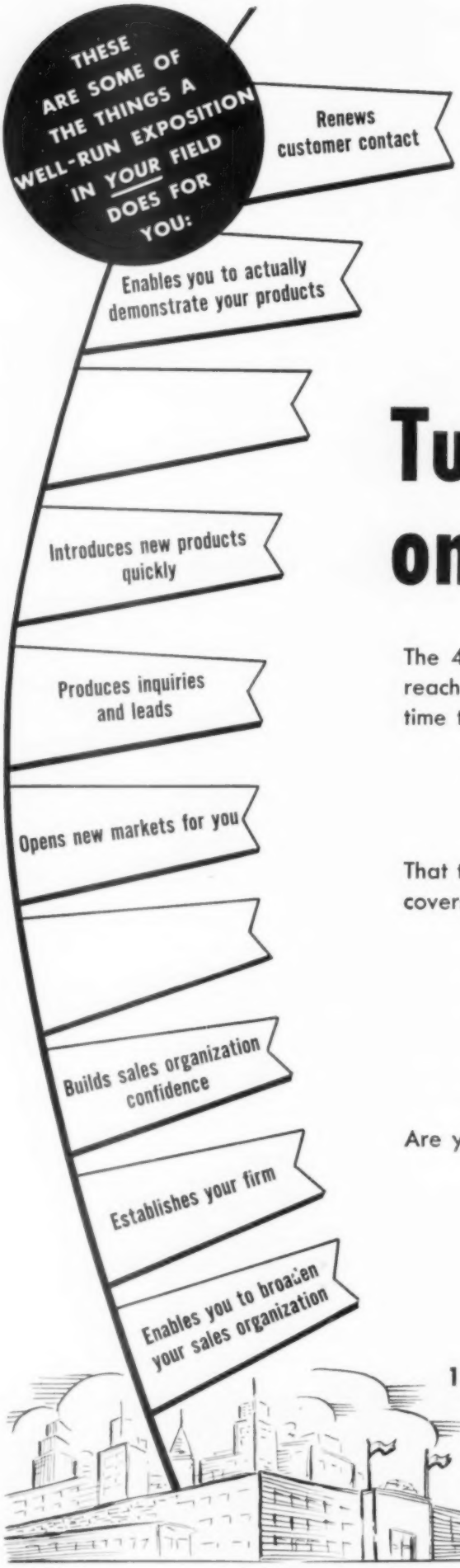
SPEEDS. Standard machine spindle speed range is from 76 RPM to 614 RPM. For heavier boring or facing operations the machine can be furnished with slow speed top driving gears, giving a spindle speed range of from 27 RPM to 220 RPM. To secure slower speed range, only a top driving gear change is necessary.

Write BAKER for full information on Standard Baker Drills.

SINCE 1867

BAKER BROS. INC., TOLEDO, OHIO

DRILLING . . . TAPPING . . . KEYSEATING . . . CONTOUR GRINDING MACHINES


THESE ARE SOME OF THE THINGS A WELL-RUN EXPOSITION IN YOUR FIELD DOES FOR YOU:
Renews customer contact
Enables you to actually demonstrate your products
Introduces new products quickly
Produces inquiries and leads
Opens new markets for you
Builds sales organization confidence
Establishes your firm
Enables you to broaden your sales organization

Turning the tables on your customer

The 40-hour week is tough on your salesman. He can't reach all the people he should see. They haven't got the time to talk to him in THEIR place of business.

But there is one place where they do have time to talk to him—where they even ASK the salesman for a sales talk.

That time and place is at the particular Exposition which covers your own and your prospect's trade and industry.

Your prospects know that at these expositions they will find the latest and best products available in their and your field. They spend the time—plus millions of dollars—just to put themselves in a position where YOU can tell them about YOUR product.

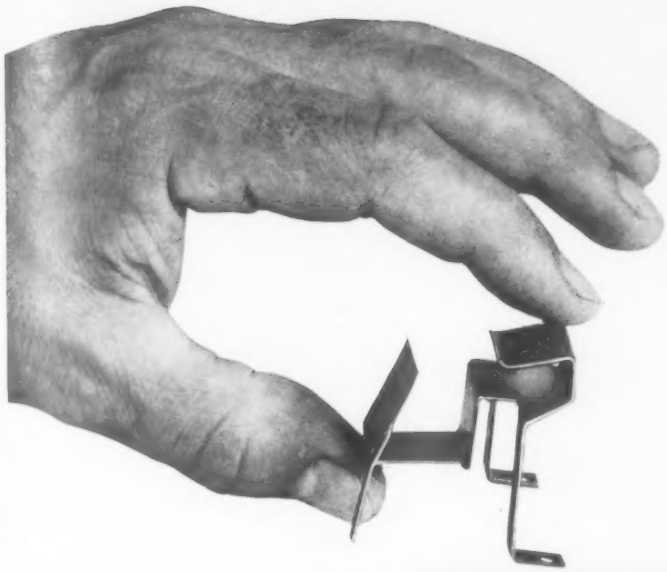
Are you taking advantage of the opportunity?

ASTE INDUSTRIAL EXPOSITION

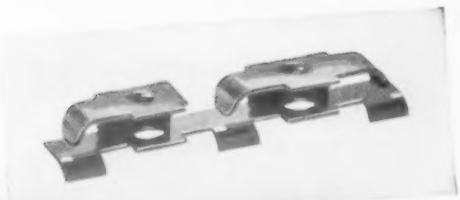
March 17-21, 1952 Chicago, Illinois

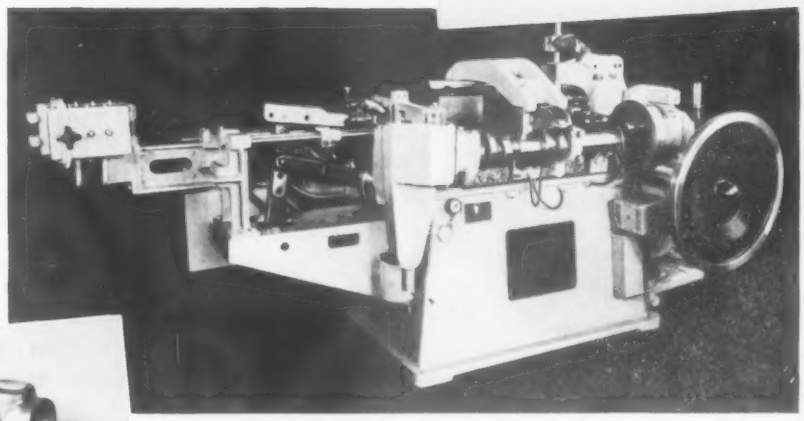
American Society of Tool Engineers

10700 Puritan Avenue Detroit 21, Michigan



Produce Parts Like These More Efficiently on the U.S. MULTI-SLIDE®





The parts illustrated here are just a few of the many different types of precision metal stampings which can be produced to advantage on the U. S. Multi-Slide ®

Produce Parts Complete — Reduce Costs — Increase Production

These and many other formed stampings can be produced complete at each stroke of the machine, eliminating secondary operations, handlings and inspections.

Improve Quality

Because all operations are performed in one machine, formed stampings are produced uniformly to close tolerances on the U. S. Multi-Slide.

Versatility

The various movements obtainable on the U. S. Multi-Slide are provided by units which are part of the machine equipment, and do not have to be built into the tools. Tools for any one size of U. S. Multi-Slide can be used with any other U. S. Multi-Slide of the same size.

Four Sizes

U. S. Multi-Slides are now built in four sizes. Illustrated is the No. 33 U. S. Multi-Slide for material up to 2½" in width and feed length adjustable up to 12½". Complete specifications for the four sizes are contained in Bulletin 15-E. Write for a copy.

US PRODUCTS

U. S. TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

Builders of U. S. Multi-Slides—U. S. Multi-Millers

U. S. Automatic Press Room Equipment—U. S. Die Sets and Accessories

THESE ARE SOME OF THE THINGS A WELL-RUN EXPOSITION IN *YOUR* FIELD DOES FOR YOU:

- Brings your prospects to you
- Enables you to actually demonstrate your products
- Renews customer contact
- Introduces new products quickly
- Establishes contact with people your salesmen can't reach
- Produces inquiries and leads
- Opens new markets for you
- Builds sales organization confidence
- Establishes your firm
- Enables you to broaden your sales organization

NOTHING TO SELL ?

One of the most trying times any company can go through is when it is "sold out".

With nothing to sell, contacts with customers and prospects inevitably lag, morale of the sales organization weakens, worries mount as to what you will do "when the rush is over".

There is a simple answer to all this—the exposition which covers your and your customers' trade or industry—the one time and place where your customers and prospects will come to see YOU.

By exhibiting, you renew and maintain your customer contacts, you can discuss 'future business', you maintain and rebuild morale in your sales organization, you keep your company and your products 'sold'.

The one time you should *not* fail to exhibit is when you have "nothing to sell".

ASTE INDUSTRIAL EXPOSITION
March 17-21, 1952 Chicago, Illinois

American Society of Tool Engineers
10700 Puritan Avenue Detroit 21, Michigan

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

Our Tool Steel Engineer Says:

Double-Tempering adds service life to high-alloy tool steels

It's always best to double-temper tools made from the high-alloy tool steels such as the high-speed and hot-work types. These steels retain more austenite than tool steels with low-alloy content.

The first tempering relieves stresses in the martensite formed in the quench . . . and conditions the retained austenite so that it transforms to martensite during cooling from the tempering temperature. A second tempering relieves stresses due to the newly formed martensite.

Omitting a second temper on hot-work steels may lead to early failure by heat-checking. And with high-speed steels and high-carbon, high-chromium steels, such omission may result in abnormal sensitivity to grinding checks.

Scissors by the Million with Swaging Dies of 67 Chisel

A leading scissors-maker is an enthusiastic user of our 67 Chisel tool steel. He makes a variety of scissors, but specializes in the blunt-end kind that young folks use for paper dolls and such.

One of the cold-swaging dies of 67 Chisel has produced about 1,100,000 pieces. They have redressed the die five times since it was placed in service, each time removing about .003 in. And the shop reports that the die is good for plenty more.

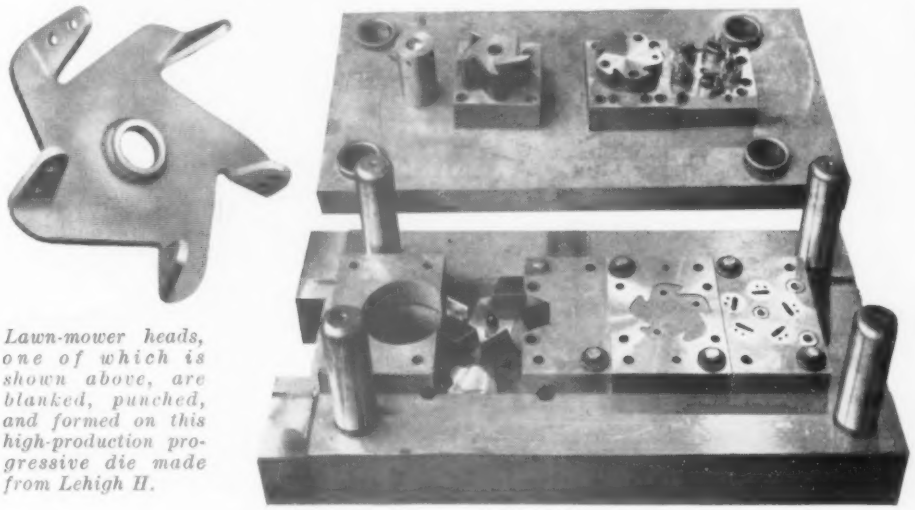
Here's a case that illustrates the satisfactory wear-resistance that can be obtained with a steel that's basically a shock-resisting type. 67 Chisel, in fact, is quite versatile. It's fine with all sorts of tools that have to withstand heavy impacts. And when carburized for extra-long-wearing service, this chrome-tungsten grade is first choice for master hobs used in cold-hobbing mold cavities.

Lehigh H Trims Costs on Lawn-Mower Heads

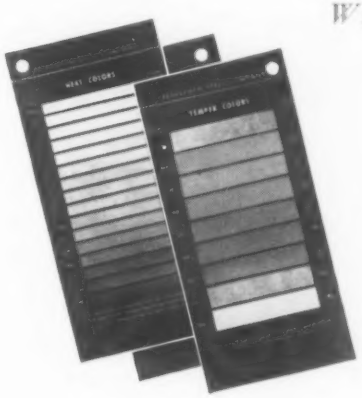
Giving your lawn that well-groomed look depends a lot on the precision of your trusty mower. The "head", for example, is a pretty important part of a lawn mower because it keeps those whirling blades in proper alignment.

These heads are produced by one large manufacturer on a progressive die of our Lehigh H tool steel which blanks, punches, and forms them from 3/16-in. steel strip. Hardened to Rockwell C-60, this die is mounted in a 200-ton press and turns out about 2000 pieces in an 8-hour shift. Costs are kept low by the long-wearing properties of this high-carbon, high-chromium tool steel.

Lehigh H is a good choice for this operation because it has the maximum wear-resistance necessary for long-run jobs involving severe service. And because it's air-hardening, it keeps distortion to a minimum during heat-treatment.



Lawn-mower heads, one of which is shown above, are blanked, punched, and formed on this high-production progressive die made from Lehigh H.



WRITE FOR THIS HANDY CHART OF HEAT AND TEMPER COLORS

Thousands of steel users and treaters depend on this convenient color guide to estimate the temperatures of heated steels. Printed in full, natural tones, the heat colors are on one side and temper colors on the other side. The lemon, orange, brown, blue and other colors that indicate the temperatures of heated steel are accurately reproduced. Both Fahrenheit and Centigrade figures are given for each color.

If you'd like to have one, write our Publications Department, Room 1041, Bethlehem, Pa. Ask for the Heat and Temper Color Chart.

Bethlehem ULTRASONIC TESTED **Tool Steel**

Medal of Honor

Sergeant Travis Watkins, Gladewater, Tex.—Medal of Honor

Private First Class Melvin Brown, Mahaffey, Pa.—Medal of Honor

Lieutenant Frederick Henry, Clinton, Okla.—Medal of Honor

Major General William F. Dean, Berkeley, Calif.—Medal of Honor

Sergeant Charles Turner, Boston, Mass.—Medal of Honor

This is the season when you think of stars. The one over Bethlehem. The ones on Christmas trees.

But this year remember another star, too—the one on the Medal of Honor. And make a place in your heart for the brave, good men who've won it. Men who, oftener than not, made the final, greatest sacrifice—so that the stars on your Christmas tree, and the stars in your country's flag, might forever shine undimmed.

Right now—today—is the time to do something important for these men who died for you. You can, by helping to defend the country they defended so far "above and beyond the call of duty."

One of the best ways you can make defense *your* job, too, is to buy more . . . and more . . . and more United States Defense Bonds. For your bonds help strengthen America. And if you make this nation strong enough you'll create, and keep, the peace for which men died.

Buy Defense Bonds through the Payroll Savings Plan where you work or the Bond-A-Month Plan where you bank. Start today!

Peace is for the strong...Buy U. S. Defense Bonds

The U. S. Government does not pay for this advertisement. It is donated by this publication in cooperation with the Advertising Council and the Magazine Publishers of America as a public service.

This MEEHANITE Ram Cylinder is...

"GUARANTEED AGAINST FAILURE"

Left—Ross & Company 20 Ton Hydraulic Press for Shop—Tool Room or Production Line

Right—The double acting Meehanite Ram Cylinder, honed to a mirror finish, is the heart of the hydraulic pump system.

Ross & Company, Chicago, Illinois, manufacturers of the 20-ton hydraulic press illustrated, fully guarantee their product "against failure due to workmanship or *material* for six months after date of sale." As an important component of this unit they specify only Meehanite cylinders which must be honed to a mirror finish. The versatility and accuracy of the action of the hydraulic pump is largely dependent upon the cylinder and its flawless, long wearing surface.

Only through rigid control of the metal structure can the needed engineering characteristics for a part of this type be obtained regularly and consistently. The Meehanite production processes provide these controls with the result that to designers, engineers and production executives throughout industry, Meehanite castings are synonymous with better properties, uniformity, dependability:—in a simple word QUALITY.

Write for our 25th Anniversary booklet "25 Years of Proof in Service."

25th Anniversary METAL 1926-1951

MEEHANITE®

NEW ROCHELLE, N. Y.

Take *YOUR* Casting Problem To A MEEHANITE FOUNDRY

American Brake Shoe Co.	Mahwah, New Jersey
The American Laundry Machinery Co.	Rochester, New York
Atlas Foundry Co.	Detroit, Michigan
Banner Iron Works	St. Louis, Missouri
Barnett Foundry & Machine Co.	Irvington, New Jersey
E. W. Bliss Co.	Hastings, Mich. and Canton, O.
Builders Iron Foundry	Providence, Rhode Island
Continental Gin Co.	Birmingham, Alabama
Crawford & Doherty Foundry Co.	Portland, Oregon
The Cooper-Bessemer Corp.	Mt. Vernon, Ohio and Grove City, Pa.
Empire Pattern & Foundry Co.	Tulsa, Oklahoma
Farrel-Birmingham Co., Inc.	Ansonia, Connecticut
Florence Pipe Foundry & Machine Co.	Florence, New Jersey
Fulton Foundry & Machine Co., Inc.	Cleveland, Ohio
General Foundry & Manufacturing Co.	Flint, Michigan
Greenlee Foundry Co.	Chicago, Illinois
The Hamilton Foundry & Machine Co.	Hamilton, Ohio
Hardinge Company, Inc.	New York, New York
Hardinge Manufacturing Co.	York, Pennsylvania
Johnstone Foundries, Inc.	Grove City, Pennsylvania
Kanawha Manufacturing Co.	Charleston, West Virginia
Lincoln Foundry Corp.	Los Angeles, California
E. Long Ltd.	Orillia, Ontario
Otis Elevator Co., Ltd.	Hamilton, Ontario
The Henry Perkins Co.	Bridgewater, Massachusetts
Pohlman Foundry Co., Inc.	Buffalo, New York
Rosedale Foundry & Machine Co.	Pittsburgh, Pennsylvania
Ross-Meehan Foundries	Chattanooga, Tennessee
Sonith Industries, Inc.	Indianapolis, Ind.
Standard Foundry Co.	Worcester, Massachusetts
The Stearns-Roger Manufacturing Co.	Denver, Colorado
Traylor Engineering & Mfg. Co.	Allentown, Pennsylvania
Valley Iron Works, Inc.	St. Paul, Minnesota
Warren Foundry & Pipe Corporation	Phillipsburg, New Jersey

"This advertisement sponsored by foundries listed above."

Enco's HEAVY DUTY "MITI-MITE" NO. 150

The new, amazing magnetic base holder for mounting Test Indicators to flat or curved surfaces INSTANTLY!

NO MORE CUMBERSOME HAPHAZARD CLAMPING

Handsomely wooden boxed $15.50

Accessories for indicators up to 3" dia.

Magnetic pull app. 100 lbs. Base 1¼" x 4"

Ideal for—

- Indicating purposes on Lathe, Shaper, Mill, Planer.
- Also, indispensable to set-up men.

Photo shows Model No. 150 used as a surface gage, by mounting holder on shoe No. 155 which allows it to be used on iron or steel surface plates as well as glass or marble.

Ball and socket swivel construction

Fingertip control for magnet release

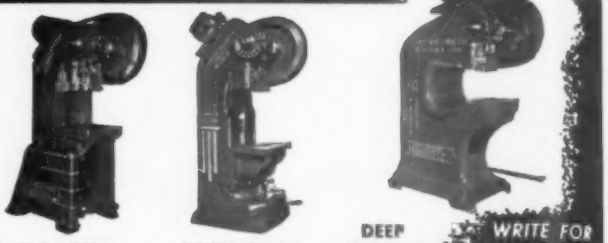
Order from your Mill Supply Dealer or send order with name of Mill Supply Dealer. Send for Bulletins 602 & 603 showing additional MITI-MITE Tools.

Enco Manufacturing Co., Dept. 412
4524 W. Fullerton Ave., CHICAGO 39, ILL.

See our booth at A.S.T.E. show, Chicago, in March.

USE READER SERVICE CARD; INDICATE A-1-174-1

EFFICIENT—LOW COST PRODUCTION MEANS ROUSSELLE PUNCH PRESSES



O. B. I. PRESS

HORN PRESS

DEEP THROAT

WRITE FOR DETAILS

SERVICE MACHINE COMPANY

7627 S. Ashland Ave. • Chicago 20

USE READER SERVICE CARD; INDICATE A-1-174-3

TO OBTAIN FURTHER INFORMATION ABOUT ADVERTISERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THIS ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 99.

NO POSTAGE NEEDED

For quick, accurate, on-the-spot hardness testing, reading directly in the Rockwell scales.

Ames PORTABLE HARDNESS TESTER

Flat and round bars, sheets, tubing and wire are tested on the spot without cutting off specimens. Punches, dies, cutters, saws and odd-shaped pieces are tested before and after heat treating. Used by metallurgists, inspectors and heat-treaters. Sizes for work 1" to 6" round and flat. Send for circular.

Complete with two penetrators, anvils, test blocks, case and chart

AMES PRECISION MACHINE WORKS

Makers of Precision Bench Lathes & Milling Machines

WALTHAM 54, MASSACHUSETTS

USE READER SERVICE CARD; INDICATE A-1-174-2

Solving Dust Problems

with TORIT DUST COLLECTORS

Lint, dust, polishing paste, all are trapped by this TORIT DUST SEPARATOR

Here is a Torit 19-FB Dust Separator connected to a double end polishing lathe. Note the complete accessibility of the buffing wheels and how a minimum of piping reduces friction losses. Here, dust laden air is cleaned and recirculated. No heat is lost through outside vents.

Torit dust collecting equipment is improving working conditions and preventing dust damage in every type of American industry. There are models for all standard applications and special adaptations can be quickly fabricated. They are economical to buy and install and exceptionally efficient in operation. For complete details and latest Torit catalog, write:

Self-contained units for carrying away dust-laden air around grinding, cutting and polishing wheels, wood saws, sanding belts, etc.

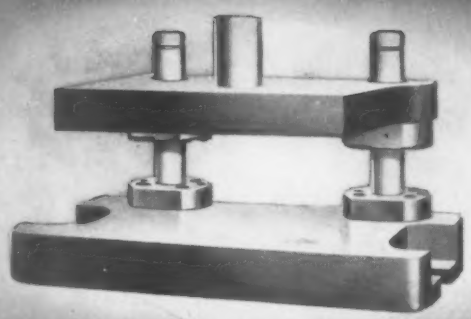
TORIT MANUFACTURING CO.

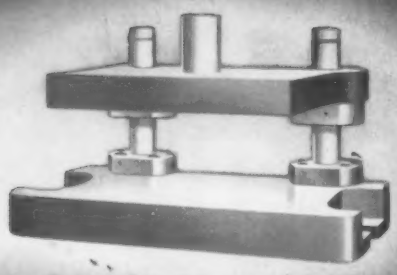
281 Walnut Street
St. Paul 2, Minn.

USE READER SERVICE CARD; INDICATE A-1-174-4

BAUMBACH DIE SETS...

A reliable service for the Stamping Industry





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Technical Service Co.
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Telephone Alpine 4897

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Iowa Machinery & Supply Co.
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1231 Piggott Ave.
Telephone Bridge 8378

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Telephone 3-5310

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Manufacturer's Supply Co.
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Telephone 9-8336

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Specialty Manufacturing Co.
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Telephone Valentine 8816

INDIANAPOLIS, IND.
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718 Market St.
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Telephone Nester 8663

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National Steel Sales Co.
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TORONTO, ONTARIO, CANADA
Production Tools
192 Queen St. West
Telephone Plaza 3813

E. A. BAUMBACH MFG. CO.

1810 S. KILBOURN AVENUE • CHICAGO 23, ILLINOIS

New Streamlined Production Technique That Saves Both Days and D[illegible]llars

50B50 steel bars are progressively heated to 350°F at the rate of 900 feet per hour, by a TOCCO Induction Heating patented process.

De-scaling Bars with TOCCO* Induction Heating

THE PROBLEM—Axle shaft blanks for famous International Harvester farm tractors are normalized, hardened and drawn in conventional open-fired gas furnaces. Considerable scale is formed by these heating operations which, of course, must be removed. Formerly these heavy bars (85 lbs. each) had to be trucked to tumble mills for cleaning. This took time and money—over $7000 annually in labor costs alone, not counting heavy maintenance expense on the tumble mills.

THE SOLUTION—International Harvester engineers found that by using TOCCO* Induction Heating to raise bar surface temperature suddenly to 350°F the thermal shock removed the scale cleanly and completely. Bars are now *automatically* fed to descaling unit, *automatically* descaled by TOCCO, and *automatically* ejected onto pallets. The draw furnace operator merely "keeps his eye on" the descaling operation—no separate operator is needed—and best of all, expensive and time-wasting trucking to and from the tumble mills has been eliminated.

● If you have descaling, hardening, brazing, forging or melting operations in your plant, chances are TOCCO can save you time and money, too. Experienced TOCCO engineers are glad to work with you for similar cost-cutting results.

see our CATALOG in SWEET'S FILE MECHANICAL INDUSTRY

THE OHIO CRANKSHAFT COMPANY

TOCCO

*Trade Mark Reg. U. S. Pat. Off.

Mail Coupon Today

NEW FREE BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. G-1 Cleveland 1, Ohio

Please send copy of 60-page catalog "TOCCO Induction Heating."

Name_____

Position_____

Company_____

Address_____

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LINDNER

No. 15 Jig Borer

Direct-reading Optical System is free from mechanical wear
Readings in ±.00004"...settings accurate to ±.00032"
Maximum error between two boreholes ±.0004"
Longitudinal and transverse table movements 40" x 24"
Distance between table surface and boring spindle 10"–30", 34", 38"
Boring spindle speeds infinitely variable from 50-1900 RPM
Maximum boring diameter from the solid 1 19/32"
Maximum boring diameter 10"
Maximum diameter of milling cutter 5"

Write for literature and complete specifications

HERBERT LINDNER GMBH · BERLIN-WITTENAU

KURT ORBAN

KO CO., INC. INDUSTRIAL IMPORTERS

COMPANY, INC.

205 East 42nd St., New York 17 • 4220 Prospect Avenue, Cleveland 3

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-177

NEW *Klamp-Lok Insert Holder*

SPECIAL ADVANTAGES

MAXIMUM SUPPORT given insert by clamping in direction of cutting force —OPEN FACING of insert prevents chip erosion of toolholder.

QUICK ADJUSTMENT from either top or bottom gives flexibility in clamping, removing or adjusting insert.

TRIGGER ACTION spring clamp assures fast, easy insert removal—and trouble-free servicing of toolholder.

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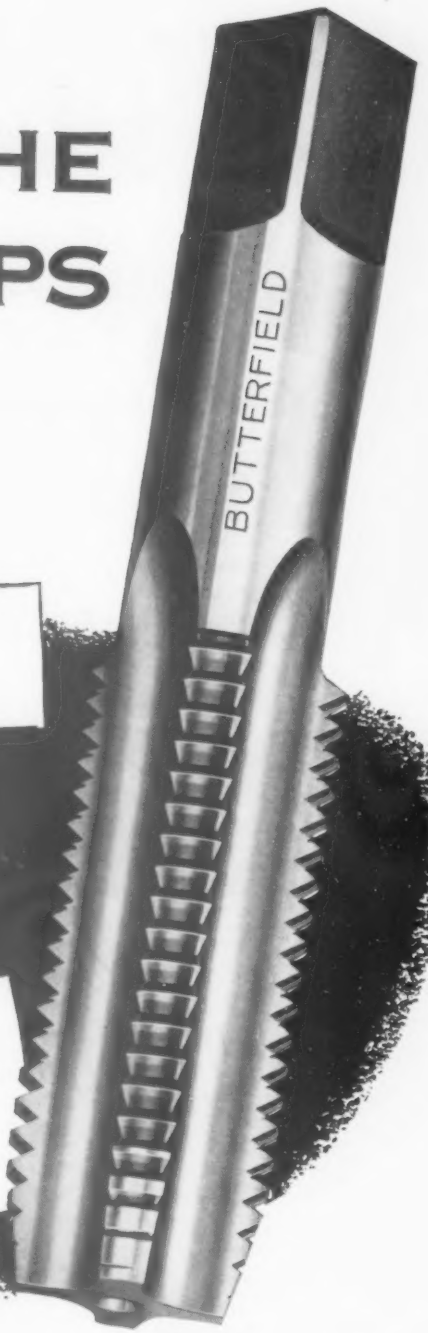

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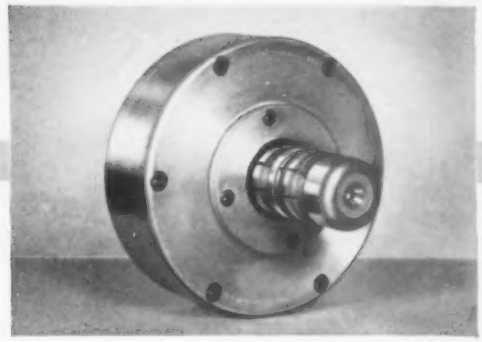

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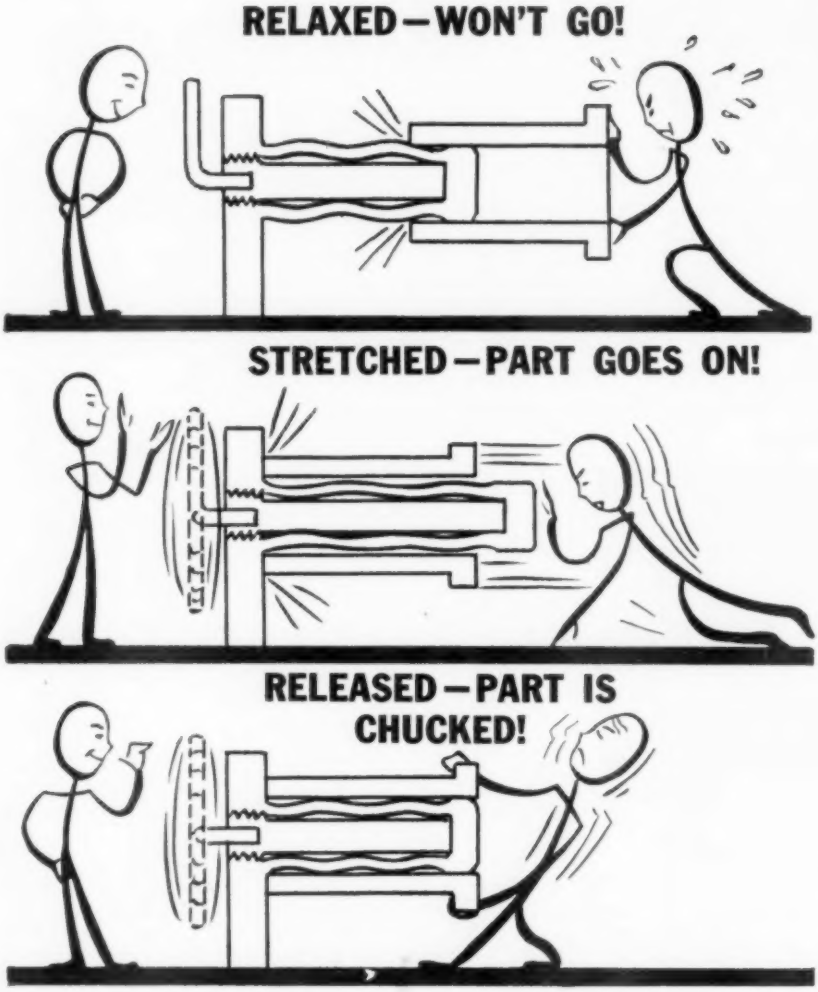

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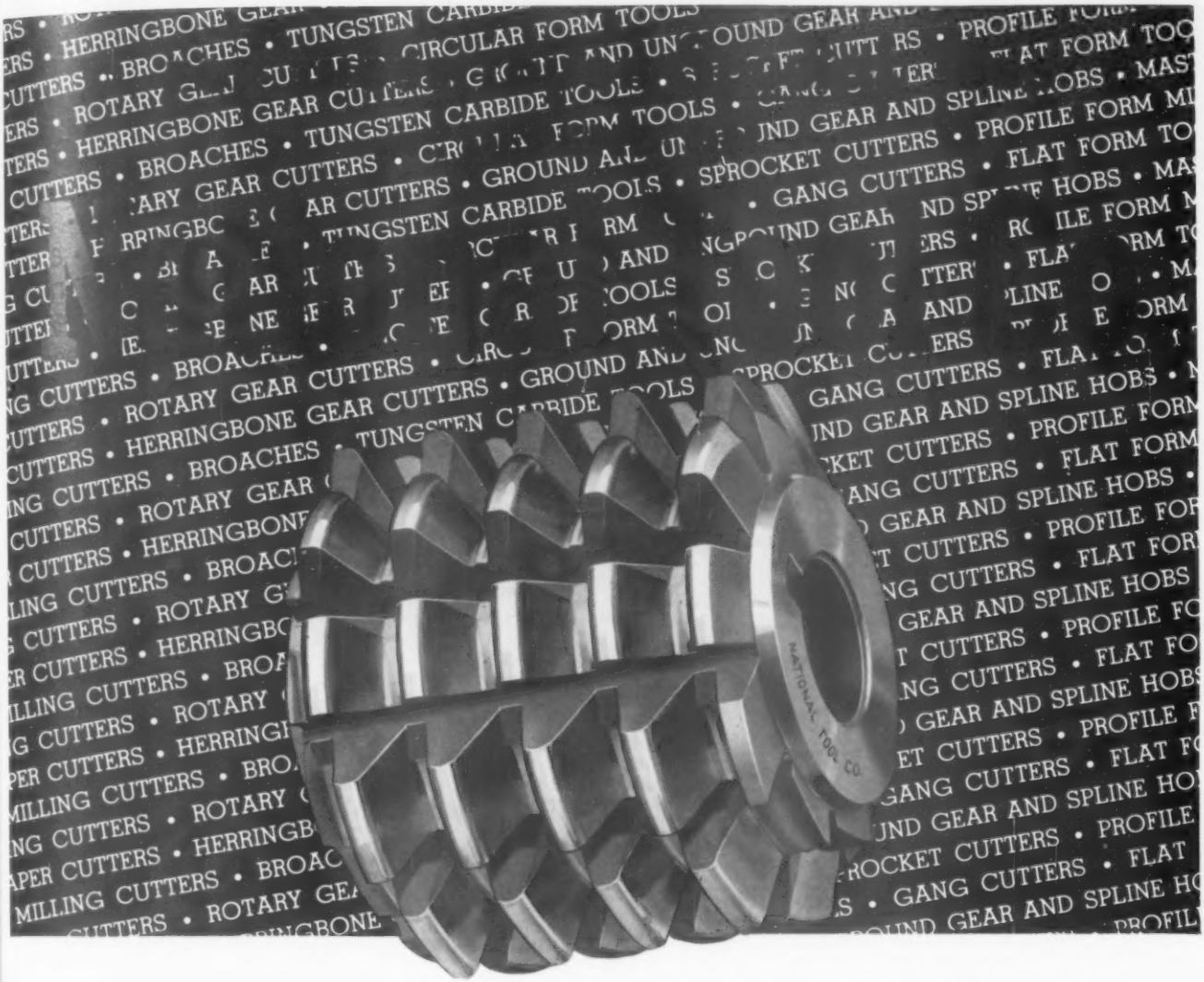

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January, 1952

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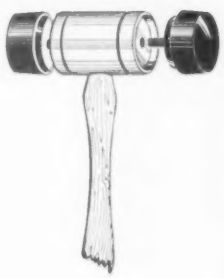

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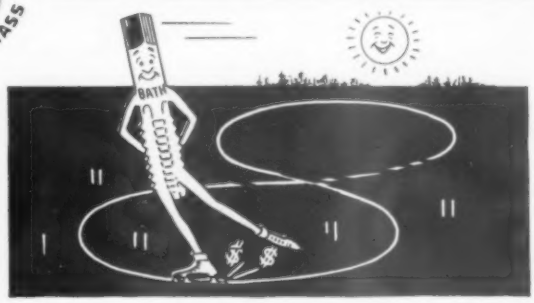

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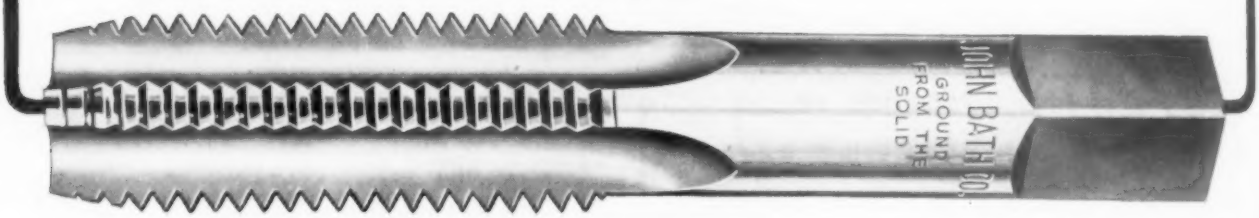

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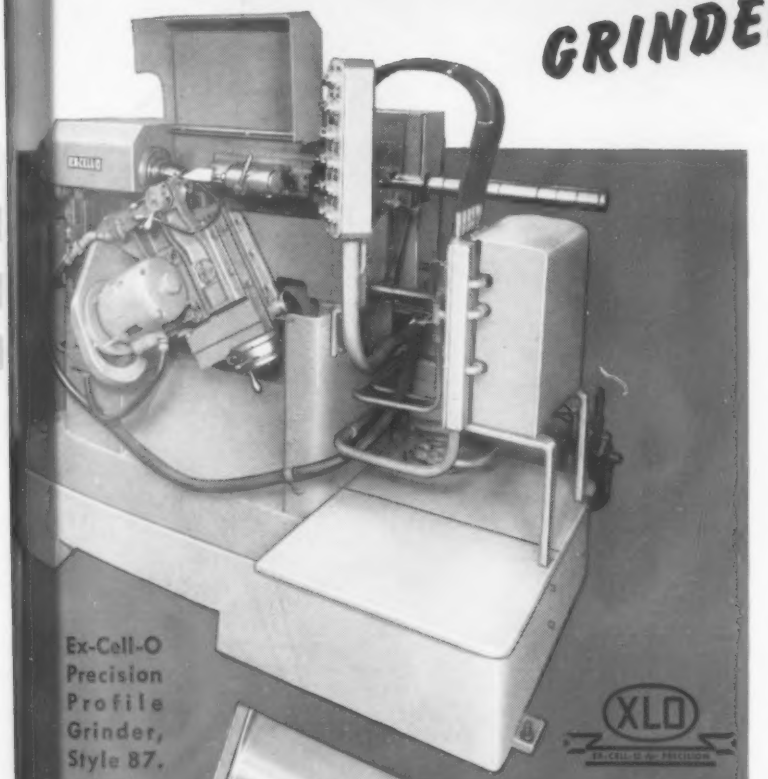

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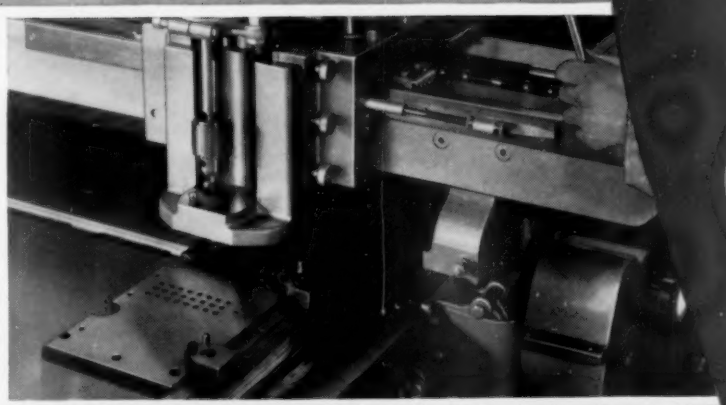
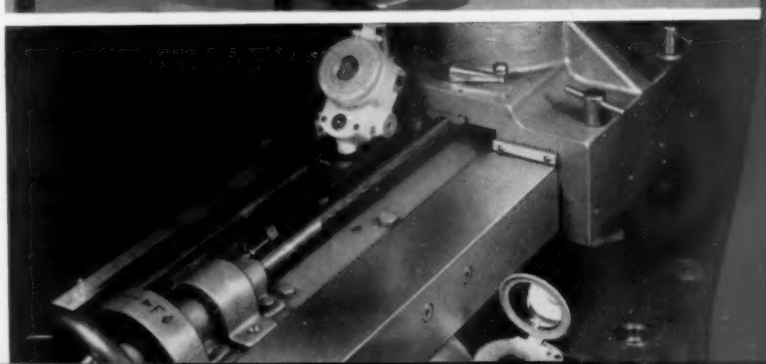
Showing the Wales Drilling Machine in operation. Note the large size template with holes being drilled on large unobstructed table.



Illustrating holes being accurately reamed in a small work piece.

Showing a Wales Extension Roller Table at each end of the Wales Drilling Machine. Note the long work piece that extends onto both extension tables from the machine table.



Showing "zeroing in" for precision accuracy by using precision optical gages